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MINNESOTA AGRICULTURAL EXPERIMENT STATION

PRODUCTION RESPONSES OF DAIRY FARMERS IN EAST-CENTRAL MINNESOTA

By

Edwin G. Strand, Junior Agricultural Economist
and
Earling Hole, Agricultural Economist

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INTRODUCTION

Studies of interregional competition are concerned with the relative advantages or disadvantages of different regions of the country in the production and marketing of commodities. Thought with respect to interregional competition in agriculture has been stimulated during recent years by the activities relating to national agricultural programs.

The Bureau of Agricultural Economics, in cooperation with the agricultural experiment stations of several States in the dairy regions, has been studying the past and the possible future responses of dairy farmers in selected areas in order to gain a better understanding of the forces determining interregional competition. In Minnesota, two areas are under study -

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1/ Acknowledgment is made of the assistance of George A. Pond and others of the staff of the University of Minnesota. Edwin G. Strand is primarily responsible for the first part of this report containing a description of the area studied and an analysis of general trends in livestock and crop production and their relation to weather conditions and other factors. Erling Hole carried out the analysis and wrote the section on changes in butterfat production by individual producers.

one in the southeastern part of the State and the other in the east-central. This preliminary report deals with one phase of the study in the east-central part.

Estimates of future production in competing regions are assisted by an analysis of the relationships that prevailed in the past between output and causal factors. If the factors that caused changes in output in the past can be ascertained, the evaluation of these factors relative to their future trend effects can also be undertaken.

Changes in production are reactions to changes in supply and demand factors. Factors operating on the supply side may be of short-time unpredictable character like weather conditions, or they may be of a long-time persistent and predictable character like technological improvements such as the use of alfalfa. Similarly, the demand factors may be divided into those of a short-time character which flow from ups and downs in business conditions and those of a long-time character such as increases in population or new uses for the product.

From an interregional competition standpoint, it is the long-time persistent changes in normal production which are important. Short-time episodic changes are not so important except as a study of them may contribute to a better understanding of the long-time trend.

In this report a description is first given of the physical characteristics, agricultural development, and type of farming in east-central Minnesota. Then annual variations in certain physical and economic factors are portrayed, and an attempt is made to explain how these forces have affected crop and livestock production, especially the production of butterfat, in this area. Lastly, a detailed analysis is given of the production responses during the period 1927-37 of 54 representative dairy farmers, together with several summaries of actual farm cases illustrating the adjustments made by operators in various situations.

The type of farming in east-central Minnesota is primarily dairying, with butterfat as the principal source of cash farm income. The farmers have no close alternatives to dairying and are at a relatively great disadvantage in the production for sale of other farm products.

The first major job in the study here reported was to obtain comprehensive data on butterfat sales and the prices of butterfat, feeds, and other farm products for a series of recent years. Information relative to total annual sales of butterfat to all creameries in each county was drawn from reports of the Minnesota State Department of Agriculture. Data on monthly and annual sales to individual creameries and by individual patrons were drawn from records kept at the creameries; corresponding data relative to butterfat prices were obtained from the same sources. Records of monthly and annual quantities of butterfat bought and prices paid during the last 12 years were compiled at four representative creameries in the area. Complete records of monthly and annual sales of butterfat for the last 10 to 13 years were obtained for each of about 150 continuous patrons of one of these creameries. Information was compiled from records of feed dealers in the area relative to prices of grain and mixed feeds and the quantities of feed sold and ground during the last several years. Local market facilities and practices in general were studied.

This information was supplemented with data on average annual prices of the principal agricultural products, average annual yields of crops, and data on weather conditions.

About 60 farmers were interviewed regarding their farm organizations and practices, changes made during the past 10 years, reasons for variations in quantity of butterfat produced from year to year, and their general plans for the future.

An understanding of the production responses of farmers in east-central Minnesota will greatly aid in explaining past variations and possible future changes in butterfat production - the major economic activity in this area.

AGRICULTURE IN EAST-CENTRAL MINNESOTA

More butter is produced in Minnesota than in any other State. Minnesota has held this lead for over 20 years. Dairy farming is the most important agricultural activity for the State as a whole.

The principal dairy product marketed by farmers in Minnesota is butterfat. It is generally sold in the form of cream to creameries located throughout the State. There were 870 creameries operating in Minnesota in 1937, manufacturing a total of 276,572,665 pounds of butter valued at $91,185,299. During the past 10 years, the sale of butterfat has accounted for 23 to 27 percent of the gross cash farm income in Minnesota. Aside from the part that is sold locally, most of the butter manufactured in Minnesota is sold in large markets like New York, Philadelphia, Chicago, and Boston.

Although Minnesota's location, soil, and climate are generally favorable to dairying, not all parts of the State are equally well adapted to dairying, nor can dairy production compete equally well with other farm enterprises in all parts of the State. Prevailing physical and economic forces have caused the development of more or less distinct types of farming, varying from one part of the State to another.

On the basis of major enterprises and prevailing type-of-farm organization in the different parts of the State, the Division of Agricultural Economics of the University of Minnesota has outlined nine type-of-farming areas in Minnesota. These areas, as outlined by county boundaries, are shown in figure 1. The names given indicate the general nature of farming carried on in each area.

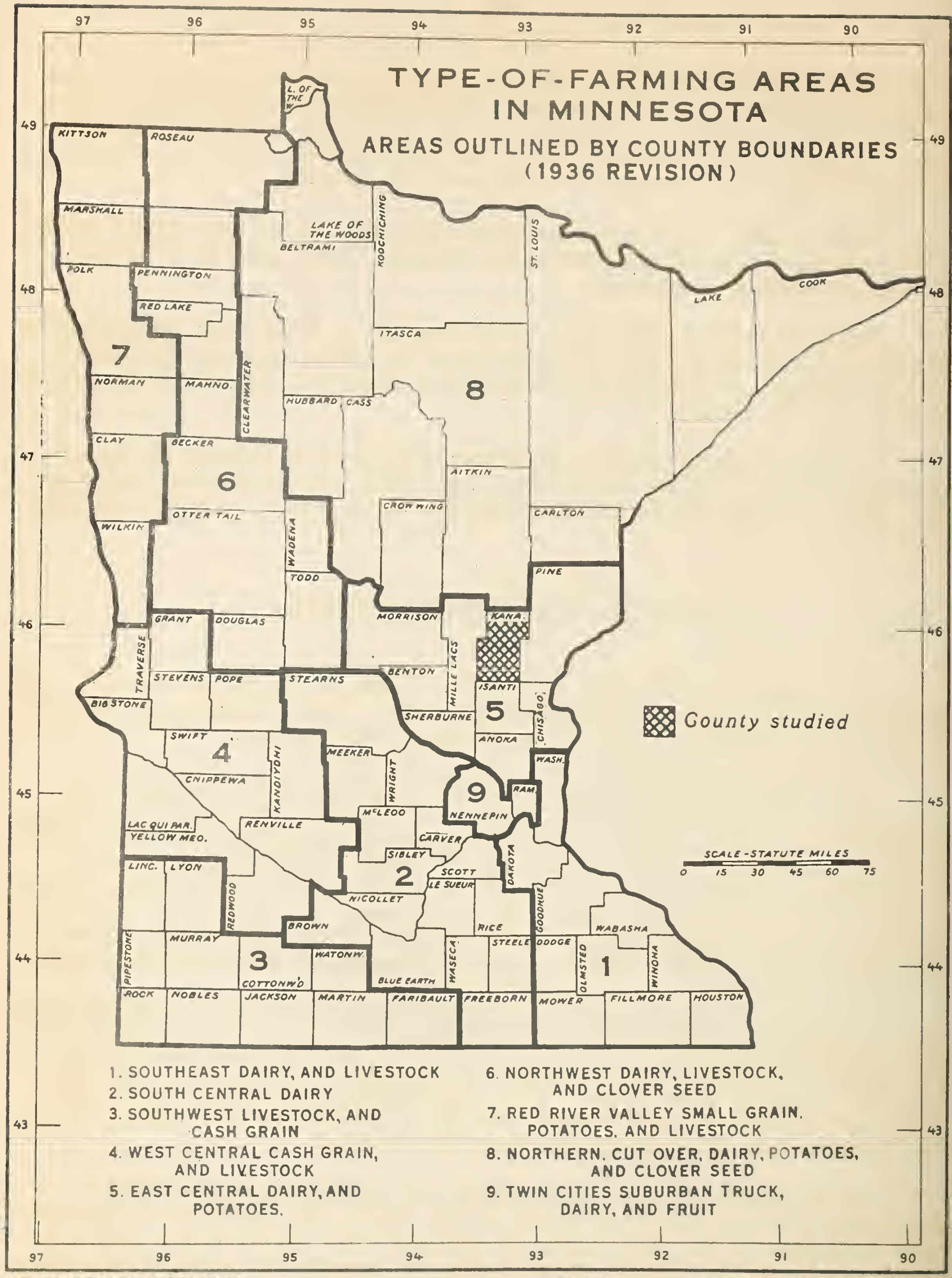

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Fig. 1.- Type-of-farming areas in Minnesota.

This report concerns primarily the east-central part of Minnesota, which is designated as Area 5 - the shaded area - in figure 1. Dairying is the predominant enterprise. Livestock other than dairy cattle are raised, but the income from them is relatively small. The production and sale of potatoes constitute an important supplementary source of income on many farms. In 1929, 42 percent of the tillable land was used for small grains, 24 percent for intertilled crops, and 27 percent for hay and pasture. Oats and rye are the principal small grains, while corn and potatoes are the important intertilled crops.

Type-of-Farming Area 5 embraces nine counties: Pine, Kanabec, Mille Lacs, Morrison, Benton, Sherburne, Isanti, Chisago, and Anoka. The total acreage of land is 3,746,560 acres. The topography varies from level to rolling, most of it being fairly level to undulating. The roughest portions are in the northern parts of Morrison and Kanabec Counties. The altitude of the area ranges from 750 feet in Anoka County to more than 1,250 feet in northern Mille Lacs County and parts of Morrison County. All of the area was glaciated, and the northern part is covered with "young red drift" and the southern part with "young gray drift." The principal surface formations are boulder clay plains, sandy to clayey moraines, stretches of wind-blown fine sand, and outwash gravel plains. In general, the heaviest soils are in the northern part, while considerable portions of the southern part have light sandy soils. The chief obstacles to farm development on the heavier soils are poor drainage and the frequently prevalent stone, stumps, and brush. On the sandy soils, the principal problems are wind erosion and drought. The average crop-growing season ranges from 120 days in the north-central to 150 days in the southern part. The average annual precipitation varies from 24 inches in western Morrison County to 32 inches along the St. Croix River. Coniferous forest originally covered the northern portion, and deciduous forest prevailed in the southern portion.

The principal economic factors that limit the types of agricultural production in east-central Minnesota are the length of the growing season, the amount and variability of rainfall, the type of soil, and the difficulty of clearing and breaking land. The frequency of relatively late spring and early fall frosts discourages the raising of corn for grain, but corn can be grown successfully for silage and fodder within the limits of the normal frost-free season. Because of its disadvantage in producing corn, the area is also at a disadvantage in producing hogs in competition with the Corn Belt. In beef production the area is at a comparative disadvantage because of its relatively short grazing season, its location with respect to the western range and eastern markets, and the farmers' inability to grow their own corn for fattening. Because of weather and soil conditions, crop yields in general tend to be somewhat lower than the average for the State as a whole, and to vary considerably from year to year. Farms are small and the cropland is limited by difficult and expensive clearing and breaking of the land. The competitive position of the area is therefore relatively poor in the production of grains and livestock that require considerable quantities of concentrates. Clovers and tame and wild grasses generally grow bountifully, providing cheap pasture and hay that can best be utilized by dairy cows. Besides making good use of the crops that can be produced with greatest relative advantage, dairy cows make possible the economic utilization of a relatively large amount of family labor per farm.

Progress of settlement in the area is indicated in table 1. Settlers came at an increasing rate until about 1900, the population being practically doubled every decade from 1860 to 1900. In general, settlement spread from the southern and western part to the north and northeast. Most of the settlers were immigrants from Europe. The larger numbers were Swedes, Germans, or Norwegians, but there were many Danes, Poles, Hollanders and Czechoslovakians, as well as smaller numbers of other nationalities.

Table 1.- Growth of population, nine east-central Minnesota counties, 1860-1930

Year	Population
1860	6,296
1870	17,472
1880	36,266
1890	61,843
1900	100,546
1910	115,493
1920	137,297
1930	136,790

United States Census

In this as well as in other parts of central and northern Minnesota, farming came after lumbering and forest fires. Pioneers seemed to think that the forest was a nuisance and that farming was the ultimate use for new lands. Settlers obtained the land for their farms by homesteading on public domain or by purchasing from private owners.

In table 2 the increase in number of farms in east-central Minnesota is shown by census years from 1860 to 1930. The total number of farms was small in 1860. The first significant increase in the area as a whole took place during the decade 1870-80. In Mille Lacs, Kanabec, and Pine Counties, a pronounced increase in number of farms did not take place until the decade 1890-1900. By 1920, the net increase in number of farms had slowed down markedly in all the counties. Since that time, farm numbers have been quite stable, except for the general increase which accompanied the back-to-the-land movement during recent depression years.

It is not easy to realize the relative newness of most of this territory from an agricultural standpoint. As late as 1890, less than 20 percent of the total acreage in any of the counties under consideration, except Sherburne, was reported as improved land. According to the census of 1910, in Pine, Kanabec, and Mille Lacs Counties less than 14 percent of the total acreages was improved.

Table 2.- Number of farms, nine east-central Minnesota counties, 1860-1930

Year	Number of Farms
1860	635
1870	1,589
1880	4,853
1890	7,426
1900	13,285
1910	14,965
1920	18,647
1930	18,424

United States Census

In 1930 there were 18,424 farms in the nine counties; 64 percent of the total land area was in farms and 30 percent was used for crops. Of all the land in farms, 47 percent was cropland and 40 percent was used for pasture. The average size of farms was 128 acres. Data on total land area, land in farms, and use of farm land in each of the counties in 1930 are given in table 3.

Table 3.- Land area and use of land in farms, east-central Minnesota counties, 1930

County	Total land area	Percent of total area in farms	Percent of total area in crops	Number of farms	Average size of farms	Percent of farm land in crops	Percent of farm land in pasture
	Acres	Percent	Percent	Number	Acres	Percent	Percent
Anoka......	275,530	70.6	36.1	1,457	132.6	51.1	34.6
Benton.....	257,330	89.8	49.4	1,591	145.6	55.0	37.7
Chisago....	269,379	86.8	41.0	2,024	115.5	47.2	42.2
Isanti.....	281,504	87.1	44.5	2,030	120.7	51.1	33.5
Kanabec....	337,537	57.0	21.9	1,535	125.2	38.5	47.1
Mille Lacs.	365,536	55.5	23.8	2,025	100.2	42.9	45.4
Morrison...	719,916	67.4	33.4	3,260	148.8	49.6	39.9
Pine.......	906,369	39.9	14.4	3,288	110.0	36.1	47.0
Sherburne..	230,530	78.6	45.5	1,214	181.7	57.9	34.6
Total.....	3691,931	64.1	30.4	18,424	128.3	47.4	40.5

United States Census

Because of comparatively recent agricultural development, type of farming did not change much during the Nineties compared with farms in earlier developed farming counties in southern and western Minnesota. From the start, the important crops in this area have been hay, oats, corn, and potatoes, with cattle as the principal livestock. But there has been a great increase in acreage of the crops and in numbers of livestock, and there has been some change in the proportions of the various crops. Dairy farming has become more and more the primary agricultural activity. On most farms the cash income from the sale of dairy products exceeds the combined receipts for all other farm products sold. 2/

The relative importance of the principal crops is indicated by their rank in total acreage in 1899 and 1929 (table 4). Hay, oats, and corn have continued as leading crops, indicating that the principal object of crop production is to furnish feed for livestock. Rye and potatoes are the principal cash crops, but the total acreage used for potatoes has declined considerably since 1920. Wheat production increased up to 1900, but after that time it decreased rapidly and is now of slight importance in most counties.

Table 4.- Rank of principal crops in nine east-central Minnesota counties on the basis of total acreage in 1899 and 1929

Crop	Rank in 1899	Rank in 1929
Hay and forage.......	1	1
Oats.................	3	2
Corn.................	4	3
Rye..................	6	4
Potatoes.............	5	5
Barley...............	7	6
Wheat................	2	7
Flax.................	8	8

United States Census

The acreage devoted to each of the principal crops in 1929 is shown in table 5. The average number of acres per farm is also shown in order to picture more readily the scale of crop production on the average farm and the relative importance of the various crops.

2/ See "Report of a Farm Management Survey of 120 Dairy Farms in Kanabec, Mille Lacs, and Pine Counties", Mimeographed Report No. 80, Division of Agricultural Economics, University Farm, St. Paul, Minn., Dec. 1936, pp. 2 and 5.

Table 5.- Acreages of principal crops, nine east-central Minnesota counties, 1929

Crop	Total acreage	Average acreage per farm
	Acres	Acres
Hay crops, total	419,161	22.75
Timothy	128,837	6.99
Clovers - red, als., mam.	16,198	.88
Clovers - sw., crim., Jap.	1,162	.06
Alfalfa	45,663	2.48
Other tame grasses	26,281	1.43
Wild grasses	198,036	10.75
Small grain hay	2,703	.15
Annual legume hay	281	.02
Oats, threshed	189,399	10.28
Corn, total	157,947	8.57
Rye, threshed	83,204	4.52
Potatoes	66,746	3.62
Barley, threshed	56,177	3.05
Wheat, threshed	26,860	1.46
Oats, fed unthreshed	2,857	.16
Vegetables, harv. for sale	2,149	.12
Flax, threshed	1,999	.11
Total acreage, these crops	1,006,499	54.63

United States Census

This area generally does not produce a surplus of feed crops. Seasons of drought or other adverse weather conditions, resulting in lowered yields, are not infrequent in short crop years. Some feed is brought in, but during years of bumper crops some farmers may have a surplus of feed crops to sell.

Data on the number of cattle and calves on farms in type-of-farming Area 5 are given in table 6. The numbers of cattle increased steadily up to 1920, then there was a slight decrease, but by 1935 the numbers were again almost equal to those reported for 1920. In all counties, except Morrison and Pine, the peak in numbers of livestock occurred about the year 1920. The number in Morrison County was slightly higher in 1935 than in 1920, but there was a period of decreased numbers between these years. In Pine County the number of cattle continued to increase until 1935; the rate of increase after 1920, however, was slower than it was previous to that year.

Table 6.- Cattle and calves of all ages on farms, nine east-central Minnesota counties, 1860-1935 1/

Year	Total number of head	Average number of head per farm
	Number	Number
1860	4,308	6.8
1880	40,126	8.3
1900	127,571	9.6
1910	181,057	12.1
1920	264,045	14.2
1925	239,109	12.9
1930	237,192	12.9
1935	255,936	12.4

United States Census

1/ Census enumerations in 1900 and before were as of June 1. They were in 1910 and 1930 as of April 15 and April 1 respectively, and in the remaining years as of January 1.

The number of dairy cows increased from 1,416 in 1860 to 171,949 in 1935 (table 7). At the same time, the proportion of dairy cows to all cattle increased from 33 percent to 67 percent. During the period 1920-25, when the number of all cattle in the area decreased (table 6), the number of dairy cows actually increased. The same is also true for the longer period, 1920-35. The average number per farm of cattle other than dairy cows declined from more than 6 in 1920 to only 4 in 1935, whereas the average number of dairy cows increased from 7.6 to 8.3.

Table 7.- Dairy cows on farms, nine east-central Minnesota counties, 1860-1935

Year	Total number of dairy cows	Percentage of all cattle that were dairy cows	Average number of dairy cows per farm	Average number of other cattle per farm
	Number	Percent	Number	Number
1860	1,416	33	2.2	4.6
1880	13,827	34	2.9	5.4
1900	49,020	38	3.7	5.9
1910	93,362	52	6.2	5.9
1920	141,126	53	7.6	6.6
1925	154,327	64	8.3	4.6
1930	143,134	60	7.8	5.1
1935 1/	171,949	67	8.3	4.1

United States Census

1/The figures for 1935 are estimates based on the number of cows and heifers 2 years old and over, since no separate figures on the number of cows kept mainly for milk production are given in the 1935 census report.

The cattle other than dairy cows are principally young dairy stock kept for replacement or for enlarging the herd. Some veal calves, cull cows, and a few steers and heifers are fattened for sale, but very few cattle are kept primarily for beef production.

The importance of poultry and egg production is reflected by the number of chickens kept. The number of chickens raised increased significantly in every county during the 20-year period, 1909-29. In 1909 the average number raised per farm was about 40; in 1929 it was 107. More than 9,000,000 dozens of eggs were produced in 1929.

Dairy cattle and chickens are the important kinds of productive livestock. Hogs are of only minor importance on most farms. Sheep are not generally kept, but flocks are found on a number of farms that have considerable amounts of rough or wooded land. Horses are kept for doing part or all of the draft work.

Dairy herds most frequently found on these farms consist of 6 to 15 cows with some young stock. A few farmers keep more than 15 cows, and a relatively small number have less than 6. The number of cows kept depends principally upon the amount of family labor available, the land available for crops and pasture, amount of barn room, financial situation of the operator, and upon personal factors such as the capacity and ambition of the operator. For temporary periods the size of a herd may be smaller than normal because of disease or because of sales made necessary by shortage of feed. In general, the dairy enterprise is a family-size business, for on most of the farms labor is not hired at all, or is hired only during the rush seasons of haying and harvest.

The general practice is to separate the milk on the farm. Cream is delivered to a nearby creamery two or three times a week, and is paid for on the basis of butterfat content and quality. The frequency of deliveries depends largely upon the quantity of cream and the warmth of the weather. Most farmers haul their own cream to the creamery, but a number use the services of a cream truck which makes regular trips over a definite route, picking up cans of cream at any farm along the way for a small charge. The skimmilk is fed to calves, poultry, or hogs. Sometimes more skimmilk is produced than the animals on the farm can consume - then the common practice is for a farmer to keep enough chickens and hogs to utilize the skimmilk produced on his farm.

Some creameries have installed equipment during recent years that enables them to handle whole milk. Milk trucks make daily trips, picking up the cans of milk on each patron's farm and delivering to the creamery, where the milk is separated, the cream is churned into butter, and the skimmilk is dried and made into milk powder. Patrons are paid on the basis of quantity of butterfat plus a small amount for the skimmilk.

PAST TRENDS IN KANABEC COUNTY

The community around Mora, in Kanabec County, was selected for an intensive study of farmers' responses and the reasons for changes in production of butterfat in east-central Minnesota. The Mora community and Kanabec County in general are typical of most of east-central Minnesota. The brief account of agricultural development and type of farming given in the preceding pages will serve as general background for this analysis of factors relating to the Mora community and to the county of which it is an important part.

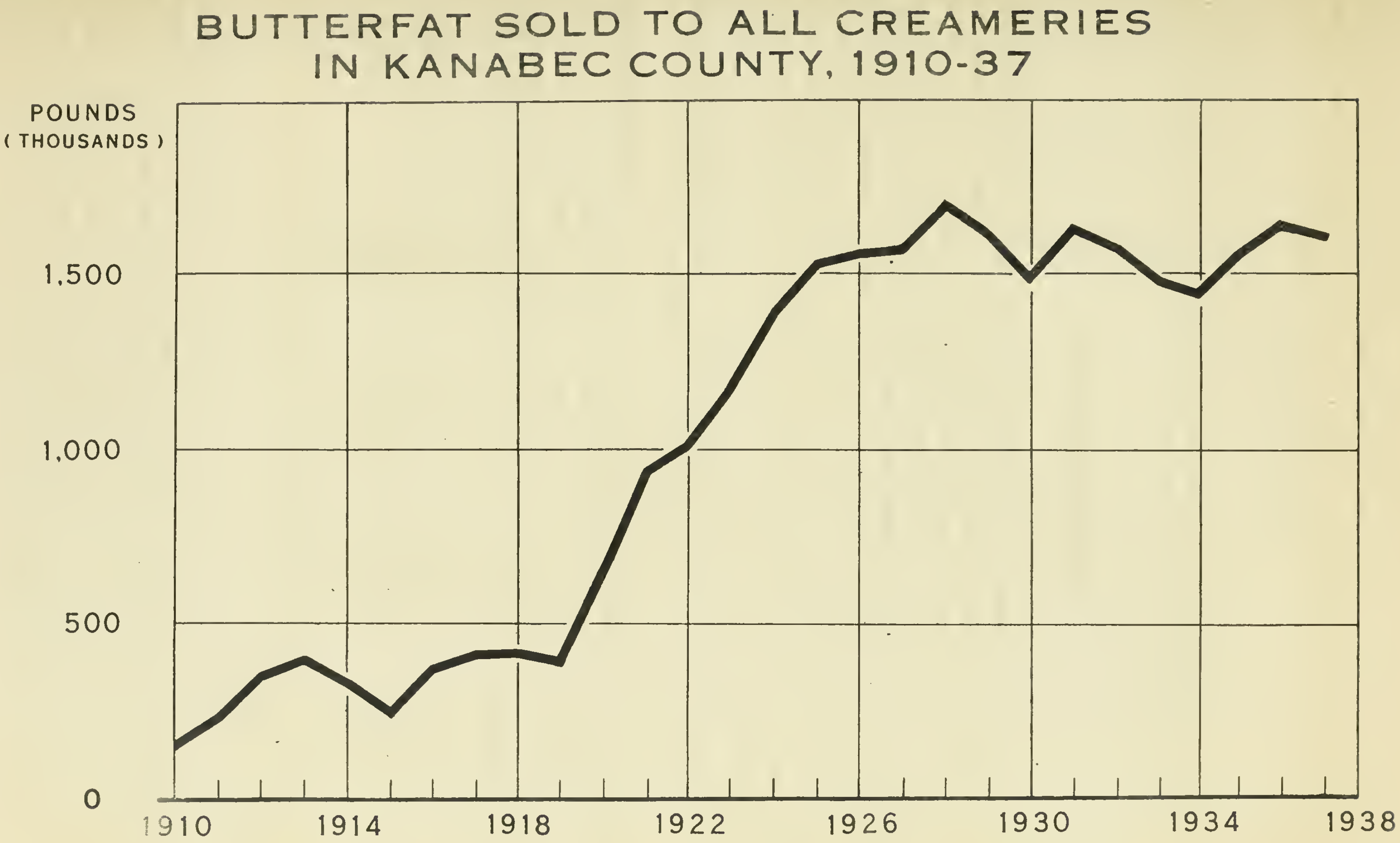
Butterfat Production

Production of butterfat in Kanabec County as reflected by sales to creameries since 1910 is indicated in figure 2. Figure 2 is based on the quantity of butterfat sold to all creameries in the county; it does not include butterfat in whole milk used on farms, butterfat in butter made on farms, and butterfat in cream and whole milk sold to other buyers than creameries. The quantity of butterfat in whole milk used by farm families is rather constant from year to year; the quantity of butter made on farms has been relatively small since 1910; and the quantity of butterfat in whole milk and cream sold to buyers other than creameries has been relatively unimportant in this county. Butterfat in whole milk fed to calves varies somewhat with the number of calves, but this variation from one year to another is relatively insignificant when compared with the volume of butterfat sold to creameries. Since 1909, the quantity of butter made on farms in this county has been small and of decreasing importance. The average quantities per farm of butter made on farms in 1909, 1919, and 1929, respectively, were 198, 98, and 25 pounds as compared with 139, 416, and 968 pounds of butterfat sold to creameries in 1910, 1920, and 1930. A relatively small quantity of the butterfat produced in Kanabec County is sold to nearby creameries located in adjacent counties, while some butterfat produced in adjacent counties is sold to creameries in Kanabec County. This movement of butterfat across county lines is not important for the purposes of this analysis, as the purchases by creameries in the county represent sales from approximately the same total area throughout the period.

Examination of available data indicates that a graph of total production of butterfat in Kanabec County would be similar in shape to that of total butterfat sales to creameries, shown in figure 2.

A great increase in butterfat production in Kanabec County since 1910 is shown by the trend of butterfat sales to creameries. The most rapi increase in production took place during the period from 1919 to 1925. 3/

3/ The quantity of butter made on farms in Kanabec County, as reported in the U. S. Census, was as follows: 1909 - 201,582 pounds; 1919 - 153,734 pounds; 1929 - 38,432 pounds.



SOURCE OF DATA: MINNESOTA BULLETIN OF INFORMATION ON CREAMERIES, ETC.
MINNESOTA STATE DEPARTMENT OF AGRICULTURE

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Fig. 2.- Butterfat sold to all creameries in Kanabec County, 1910-37.

It is apparent that after 1925 production fluctuated considerably but did not rise above the peak attained in 1928. Sales of butterfat to creameries in 1937 totaled 1,616,779 pounds, or about 11 times as much as was sold in 1910.

As changes were taking place in the production of butterfat in Kanabec County, changes were also taking place in the production of livestock, other livestock products, and crops.

Livestock Production

The changes in numbers of the principal classes of livestock on farms since 1910 are shown in table 8. The number of cows increased until about 1925, then decreased somewhat to 1930, but increased again between 1930 and 1935. The number of cattle other than dairy cows decreased after 1920, as indicated by U. S. Census data in table 7. This observation is also supported by data obtained from records of county assessments. In addition to increasing numbers of cows during the decade following the World War, farmers did a great deal toward improving the quality of their cows. There was a notable change from "common" or dual-purpose cows to higher producing Holstein and Guernsey cows.

Table 8.- Number of farms and number of cows, sheep, swine, and chickens on farms in Kanabec County on January 1, 1910-1935

Year	Number of farms	Cows and heifers 2 years old and over	Sheep and lambs of all ages	Swine of all ages	Chickens raised (previous year)
	Number	Number	Number	Number	Number
1919	1,017	6,264	2,868	1,524	24,159
1920	1,568	12,152	8,313	5,077	75,140
1925	1,484	13,400	4,963	4,529	1/
1930	1,535	12,213	12,582	3,760	142,986
1935	1,727	14,106	8,355	3,307	1/

1/ Not reported.
United States Census

The number of sheep and lambs has increased, although somewhat irregularly, since 1910 and 1920. Sheep and lambs were reported on only 370 of the 1,727 farms in 1935, and are therefore not of very general importance in the county. It is apparent that the number of hogs has been decreasing sinc 1920, but hogs have never been a very important enterprise on these farms; even in 1920 the average number per farm was small. The number of chickens trebled between 1910 and 1920 and almost doubled during the following decade.

Egg production more than doubled between 1920 and 1930.

Crop Production

Acreages of the principal crops grown in Kanabec County, year by year, for most of the years since 1920, are shown in table 9. The total acreage in these crops, the acreage in pasture, total land in farms, number of farms, and average size of farms are also shown. The average size of farms increased from 109 acres in 1920 to 119 acres in 1925, and has since remained about the same. The total acreage in farms and the total acreage in the principal crops increased rapidly from 1920 to 1925, somewhat irregularly from 1925 to 1935, and then declined slightly. The importance of feed crops in the crop production of this area has been pointed out. The data in table 9 show that there have been large increases in the acreages of corn, oats, clover and timothy hay, and alfalfa hay in this county since 1920. The acreages of barley and sweetclover hay have also increased. Especially significant are the relatively large increases in the acreages of these feed crops and of pasture from 1920 to 1925.

The principal cash crops grown in this county are rye, wheat, flax, and potatoes. Between 1920 and 1938, there was a general increase in the acreages of rye and winter wheat. Spring-wheat acreage showed little change, and flax remained relatively insignificant throughout the period. A marked decline is noted in the acreage of potatoes, especially since 1931.

Significant changes in acreage of the various kinds of hay crops have occurred. The increase in alfalfa hay has been striking. Acreage of wild hay has remained rather constant while that of "other hay" seems to have varied principally with drought conditions and consequently with the supply of regular hay obtained the previous year. The effect of the drought from 1929 through 1934 is reflected in the temporary reduction of stands of the legume hays, and the increase in acreage planted to other hay crops. With the return of better growing conditions after 1934, the usual acreage in clover and timothy has been restored and the acreage in alfalfa has been expanded rapidly.

Weather Conditions and Crop Yields

The relationships between weather conditions and crop yields are of two types, depending upon the nature of weather during a given period. For instance, favorable weather one year may alternate with unfavorable weather the next year for a number of years. Or the same kind of weather, whether favorable or unfavorable, may follow year upon year for a series of years. A certain deviation below normal precipation one year may be of minor consequence if it comes at a time when the water supply held in the soil is normal. The same deviation below normal for another year may be of major consequence, if it follows a series of years with subnormal precipitation.

Table 9.- Acreage of principal crops and pasture in Kanabec County, 1920-38

Item	1920	1922	1925	1927	1929	1931	1933	1934	1935	1936	1937	1938
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage in farms ...	149,169	156,273	169,834	171,183	166,637	177,975	180,062	175,857	186,125	183,142	180,432	176,183
Number of farms	1,366	1,278	1,422	1,445	1,429	1,503	1,518	1,515	1,577	1,544	1,506	1,482
Average size of farms	109	122	119	118	117	118	119	116	118	119	120	119
Acreage in principal crops	45,524	47,425	57,700	57,435	59,282	62,440	65,029	59,078	68,009	66,457	67,231	65,335
Acreage in:												
Corn	4,723	6,630	8,034	7,688	7,412	8,042	12,157	15,174	13,105	10,339	11,334	11,082
Oats	8,131	7,480	14,492	14,192	14,341	15,811	16,349	15,193	20,720	18,070	15,800	14,233
Barley	1,690	1,591	3,238	3,821	4,711	4,813	3,385	1,803	3,801	4,636	2,557	2,324
Rye	825	877	606	230	335	950	1,449	1,268	1,334	811	2,490	2,321
Spring wheat	573	156	610	439	463	344	394	380	780	633	428	550
Winter wheat	60	193	80	62	46	38	120	15	24	129	685	821
Flax	80	35	186	216	125	173	8	33	65	59	43	85
Potatoes	6,454	8,717	4,602	6,552	5,260	6,084	3,752	4,214	4,178	2,588	2,767	2,204
Clover-timothy hay .	8,481	9,799	11,936	9,998	12,089	10,571	7,717	2,493	3,088	7,271	8,885	9,788
Alfalfa hay	97	138	1,708	1,781	2,451	2,112	3,264	1,599	4,769	6,938	7,666	8,249
Sweet clover hay ...	5	-	105	76	178	237	653	545	880	1,508	629	881
Other hay	2,438	492	358	370	173	584	2,127	5,129	3,657	1,358	1,996	1,156
Wild hay	11,967	11,317	11,745	12,010	11,698	12,681	13,654	11,232	11,608	12,117	11,951	11,641
Pasture	1/	67,900	81,898	79,723	82,651	91,477	95,608	92,093	95,721	92,786	86,964	84,139

Minnesota State Farm Census. (This census is taken in May, and concerns the use of farm land established or planned for the given year.)

1/ Not reported.

Weather conditions of the latter type which occur at unpredictable intervals actually did occur during the period studied. The variation in weather and the accompanying effect on crop yields were factors which had a persistent effect.

The average annual precipitation in Kanabec County is about 26 inches. The average precipitation for the first 4 crop-season months (April-July) is somewhat over 12 inches, but, like the annual precipitation, this frequently varies considerably from year to year. Insufficient rainfall during the growing season often means greatly reduced yields of crops and pastures. A large portion of the agricultural soils in the county are light loams, and some areas are quite sandy. Crop damage from drought is common. There are very few farms on which total yields are reduced because precipitation in the crop season is larger than normal. Very high temperatures for several days at a time often damage crops considerably. In general, a relatively cool summer is favorable to hay and pasture production and contributes to good yields of oats and other feeds.

The supply of feed, which is determined to a very large extent by crop yields, affects the number of cattle kept as well as the rate of feeding per head. Variations in weather are therefore important in explaining year-to-year fluctuations in butterfat production.

Effects of unfavorable weather in a given area during any one year can be moderated by bringing in additional feed from outside, or by using reserve supplies of feed held over from previous years. In the absence of reserve supplies, and at times when the relative prices of feed and butterfat are unfavorable to the dairy farmers, poor crops will be reflected in lower production of butterfat. East-central Minnesota does not often produce a surplus of feed grains. But there are only limited opportunities for successful alternatives to dairying.

In figure 3, average yields of oats and tame hay which are the principal feed crops in Kanabec County can be compared with total annual and summer-season precipitation and mean summer temperature at Mora. 4/ In examining these data for relationships between precipitation and temperature conditions and crop yields, certain facts should be kept in mind. The crop of a given year is directly and strongly affected by the amount and timeliness of precipitation during the growing season. It is also affected by the amount of reserve moisture in the ground at the beginning of the growing season, which is dependent upon the amount of precipitation the previous year or during the past few years. Mean summer temperature indicates roughly the amount of very hot weather, which causes rapid evaporation of soil moisture, and is often very harmful to grain crops. Data on total annual precipitation, summer precipitation, and mean summer temperature obviously

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4/ The yield figures for corn, oats, barley, tame and wild hay are given in the appendix.

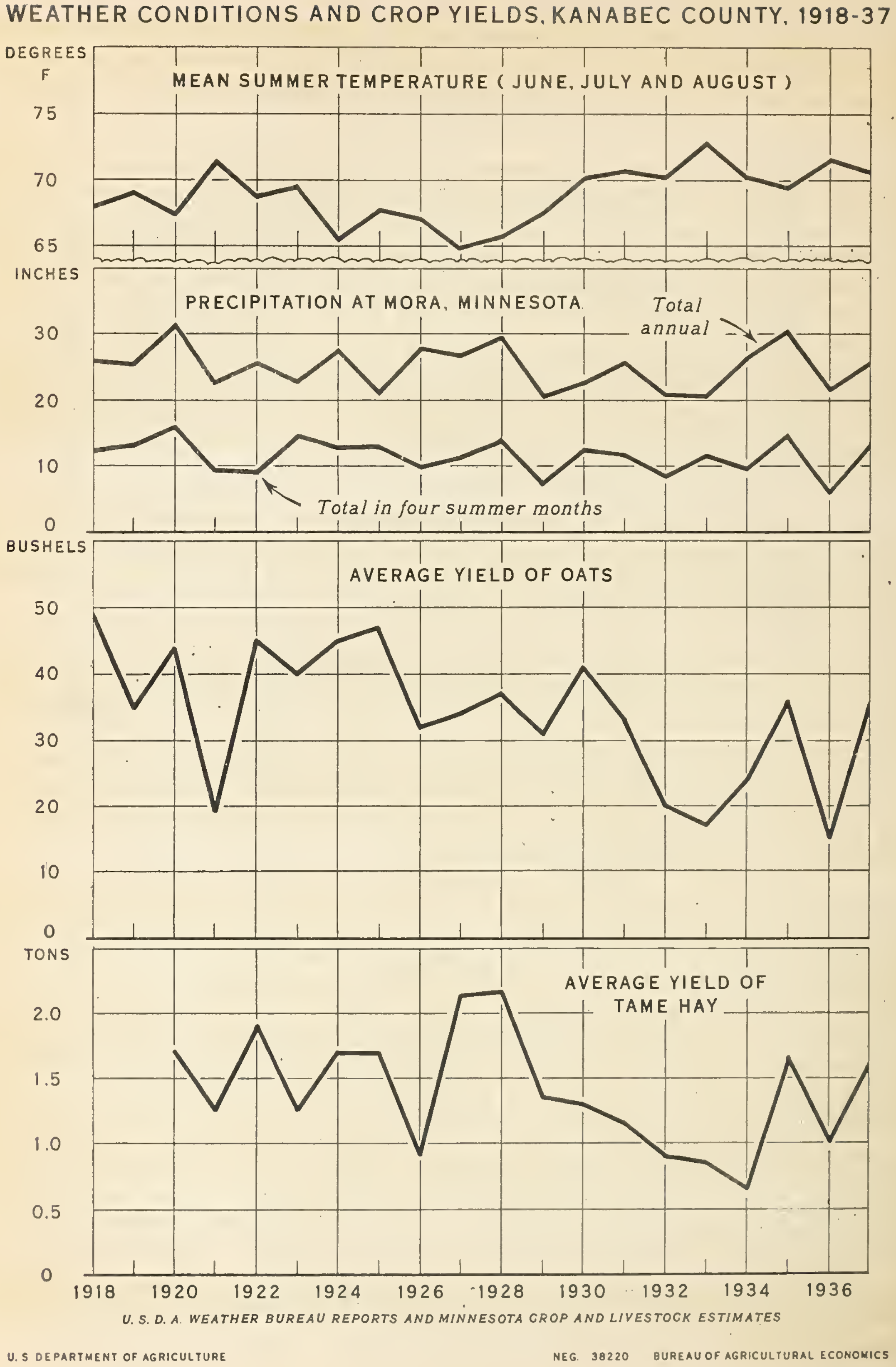


Fig. 3.- Weather conditions and crop yields, Kanabec County, 1918-37.

do not comprise refined measurements of the favorableness of weather for crop production, but a record of them has considerable value in explaining variations in crop yields. As a whole, changes in these three measures of weather conditions complement each other in explaining fairly well the changes in yields of oats and hay. 5/ The relationship between corn yields, and these three weather factors was found to be rather irregular from year to year but significant for a series of years.

The year-to-year relationship is evidently obscured by numerous other factors that affect yields, as well as by the lack of refinement in these general measures of weather conditions. In addition to being reduced by drought and frosts, crops are affected by hail, smut, rust, grasshoppers, and the like. It would be difficult to measure the influence of such factors, but it should be clear that they may frequently account for irregularities in the observed relationships between the weather conditions and crop yields represented in figure 3.

Although the relationship between the three named measures of weather conditions and crop yields is irregular for some years, based on a year-to-year comparison, the relationship between the same kind of weather conditions during a series of years and crop yields is highly significant. It is shown by table 10 that the average of crop yields for a series of years from 1929 to 1936, compared with the average for the years 1921-28, is much lower for all major crops. A similar comparison for weather conditions shows that they were more favorable from 1921 to 1928 than they were from 1929 to 1936.

Table 10.- Averages of weather conditions and crop yields, Kanabec County, east-central Minnesota

Year	Total annual precipitation	4 months summer precipitation	Mean summer temperature	Oats	Barley	Corn	Tame Hay	Wild Hay
8-yr. av.		Apr.-July	June, July, Aug.					
	Inches	Inches	Degrees F.	Bu.	Bu.	Bu.	Tons	Tons
1921-1928	25.33	11.67	67.5	37	28	29	1.63	1.35
1929-1936	23.50	10.11	70.3	27	18	22	1.11	.89

5/ Yields of pasture are also directly affected by rainfall and temperature, and this is significant because of the importance of pastures in dairy production. The pasture season is the season of highest monthly production of butterfat in this community.

Prices of Principal Farm Products

A study of the price movements of the principal cash products in east-central Minnesota since 1921 as shown in figure 4 reveals that the price of butterfat has fluctuated less than prices of other farm products. There was almost an uninterrupted rise in butterfat prices up to 1929. During this period the prices of the other products fluctuated rather widely. The depression period, however, brought all prices within close range of each other. The long-time price relationships between these four products remained apparently the same for the period indicated in figure 4.

The price relationships of these four commodities since 1921 compared with an earlier period, for instance 1910-14, indicate that important changes have taken place. The price of butterfat since 1921, relative to other principal farm products in this area, has been more favorable than it was during the period before the World War. This situation was of great importance in the decade of the 1920's.

Relationships Between Selected Trends

It is well known that agricultural production is dependent upon the physical environment and that it is affected by economic returns. The tendency for the production of various agricultural products to be "regionalized" in this country is a joint response to physical and economic forces. The variation in the prevailing type of farming from one part of Minnesota to another has also been brought about by prevailing physical and economic conditions. Even after the agricultural enterprises of a district are rather well determined, variations in production will occur in response to variations in physical conditions like weather, disease, and insect pests, and to economic conditions such as changes in the relative prices of agricultural products. Production on an individual farm will be conditioned by many other things, of course, including the human factor.

Diseases, pests, and soil conditions can be controlled to some extent by farmers, but farmers cannot do much about weather except to make relatively minor adjustments in management practices, which in turn may have more or less effect on production. Price conditions are largely beyond the control of farmers, except as such conditions may be influenced by collective action. Farmers in different areas are limited to different degrees in their alternative opportunities or in their possibilities of making economically advantageous adjustments in their production in response to changes in weather and price conditions.

Voluntary changes in production during relatively short periods are much more difficult to make in some enterprises than in others. The dairy enterprise does not lend itself easily to rapid adjustments in production because of the time required to build up a herd, the relatively large investment in cows and necessary equipment, and the general organization of

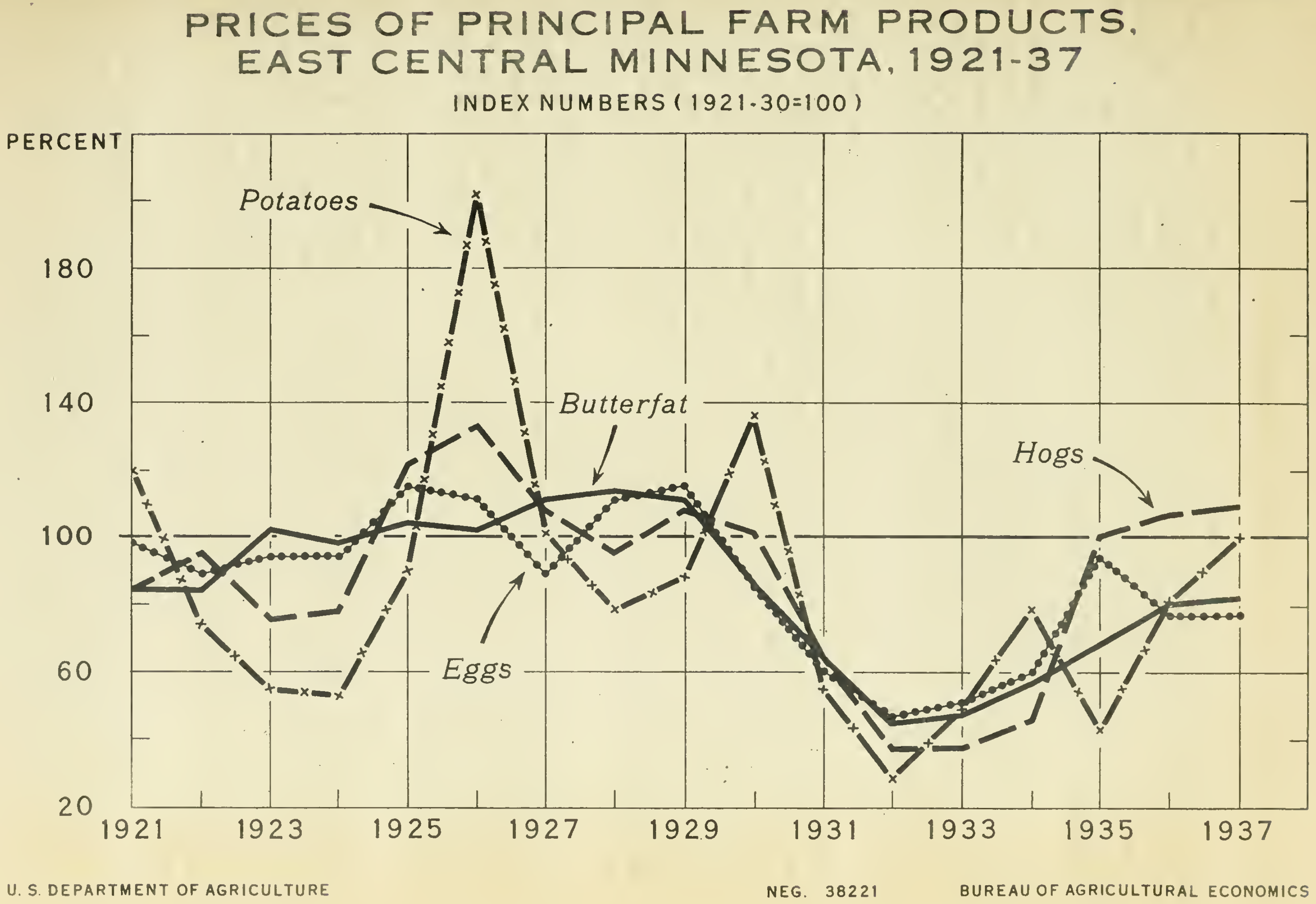


Fig. 4.- Prices of principal farm products, east central Minnesota, 1921-37

the farm business around the dairy enterprise.

The description of past trends in Kanabec County so far has discussed butterfat and livestock production, total crop acreages and distribution of crops, weather conditions and crop yields, and prices of major agricultural commodities during the period 1921-37. It is now our purpose to round out the picture by analyzing the relationships among these trends. Butterfat production has changed in response to many factors.

There was a distinct break in the trend in butterfat production in Kanabec County in 1928. During the 8-year period 1921-28 the trend was upward - a trend that started in 1919. It was steeply upward through 1925, after which the trend tended only slightly upward. No definite trend is discernible for the period 1929-36. The record production of 1928 was not again attained.

The trend in butterfat production during these two periods was not accompanied by a parallel trend in number of cows as far as can be seen from available statistics. Hence, the production per cow was similarly a variable factor. Between 1920 and 1925, there was a 10-percent increase in number of cows but a much larger percentage increase in total butterfat production. Between 1925 and 1930, there was a decrease in number of cows cancelling the increase of the previous 5-year period. In spite of this, the production continued upward although at a diminished rate of increase. The number of cows increased materially during 1930-35 in spite of a lowering of milk production.

As to other classes of livestock, there has been some decrease in hogs since 1920 and perhaps in horses. The main conclusion that can be drawn from changes in classes of livestock is that the trends in butterfat production since 1921 were chiefly caused by changes in the dairy enterprise, which were not promoted to any substantial degree by an absolute shift from other livestock enterprises into dairying.

An examination of total crop acreages and distribution of these for Kanabec County since 1920 indicates that the continuous increase in butterfat production until 1928 was accompanied by a 30-percent increase in cropland from 1920 to 1928. This new resource was used for raising feed crops for dairy cattle, thus laying the foundation for the large increase in butterfat production. As acreages in cash crops like potatoes showed no trend during the period up to 1928, it is evident that new resources rather than transfer of resources from other uses were responsible for increases in feed crops.

During the period after 1929 there was an additional increase of approximately 10 percent in crop acreages based on the 1929 acreage, but this was essentially accomplished by 1933. Besides new resources being drawn into production of feed crops, there was some significant displacements of crops. Cash crops like potatoes have decreased materially since 1931.

Alfalfa was scarcely grown in 1920, but the acreage has increased at a rapid rate ever since. It has not absolutely displaced clover and timothy but it has been largely responsible for increases in hay acreage.

The increase in crop acreages used for production of feed for dairy cattle which occured during the period 1921-28 was continued during the subsequent period, although at a lower rate of increase.

The two periods are different with respect to the relationships between crop acreages and butterfat production. During the period 1921-28, increases in crop acreages were accompanied by increases in butterfat production but this has not been the case for the period since 1929 which shows no trend in butterfat production. Factors were operative, therefore, during the latter period which tended to cancel the effect of increases in acreages of feed crops on butterfat production. The difference between the two periods with respect to the relationship between butterfat production and crop acreages used for feed crops is paralleled by differences in prices and crop yields.

The improved relationship between butterfat prices and prices of other principal farm products which became established after 1920 undoubtedly assisted in drawing new resources into dairying. The expansion of butterfat production up to 1928 may be looked on, in part at least, as a price response to improve relative prices of butterfat as compared with a still earlier period. At the same time organizational changes were taking place in the dairy enterprise itself. These consisted mostly in higher producing cows and changes in feeding practices. These changes tended to place dairying in a favorable position relative to alternative enterprises.

Price relationships between dairy products and other farm products have not shifted materially since 1929 as compared with preceding periods. Hence, the only price influence has been that due to the lower level of prices. Changes in the dairy enterprise were taking place, but they were (unlike the previous period) confined to improvements in raising of feed crops especially alfalfa for dairy cattle. These improvements tended to place dairying in a favorable position relative to other enterprises.

The major factor causing a halt to the upward trend in butterfat production in 1928 was found in unfavorable weather conditions and low crop yields. Crop yields were decidedly higher during the period 1921-28 than during the following period.

Relationships between selected factors and butterfat production for the period 1927 to 1937 are shown in figure 5.

In order to compose the joint effect of changes in acreages of the various feed crops and yields, an index of feed production for Kanabec County has been calculated. This index has been calculated in terms of total digestible nutrients contained in the crops of corn, oats, barley, and tame and wild hay. The feed production resulting from the acreage in corn is probably more inadequately determined than for the other crops, for a major portion of the corn acreage is used for silage and its yield is not given. There is not necessarily a close relationship between corn and silage yields. The condition of pasture is likely to parallel production of oats and hay.

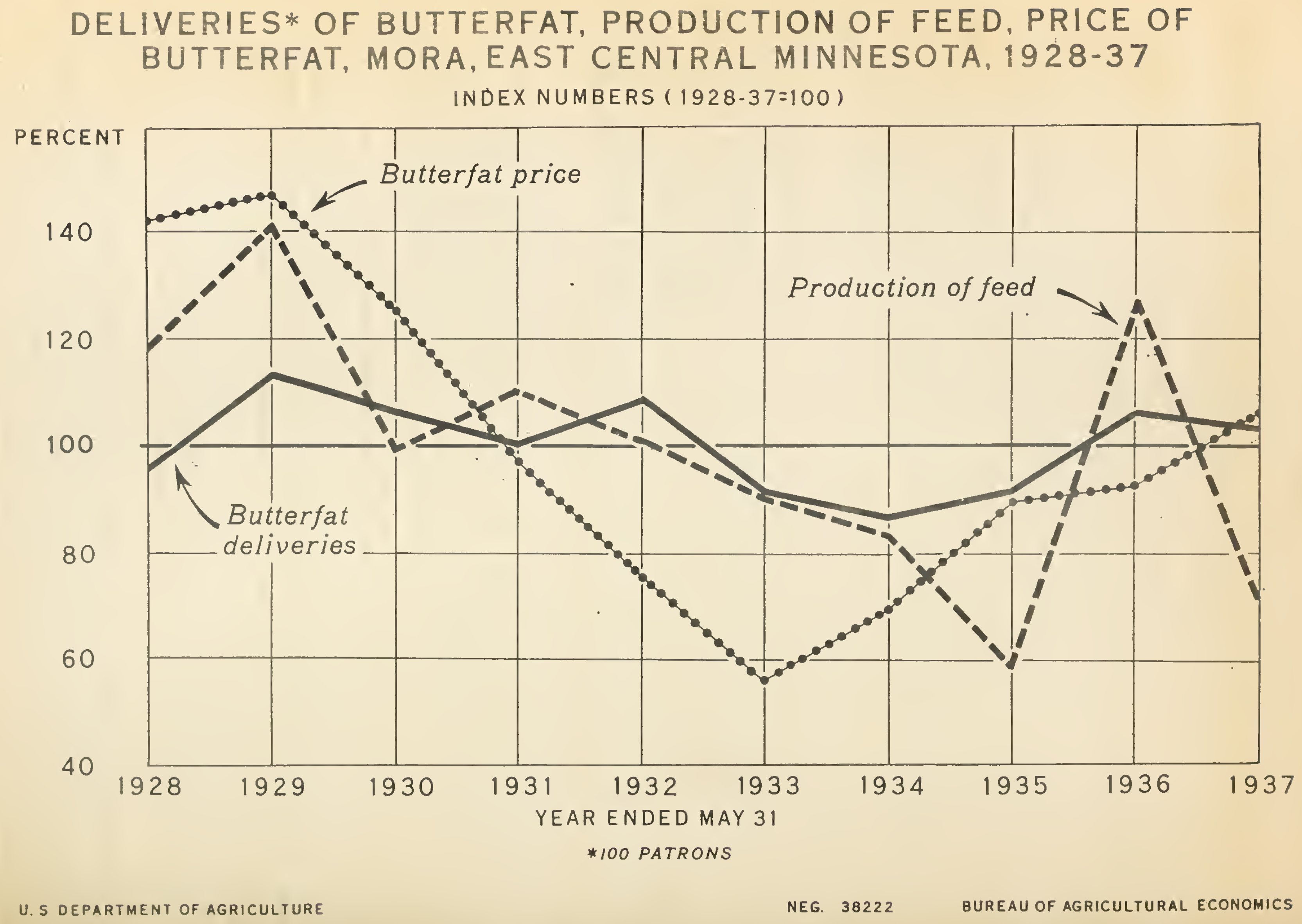


Fig. 5.- Deliveries of butterfat, production of feed, price of butterfat, Mora, east central Minnesota, 1928-37.

Purchases of feed are not of relatively large consequence. Some data on purchases of grain have been collected. These are discussed later.

As it is desirable to compare the production of crops one year with the butterfat production directly associated therewith, the butterfat production of 100 patrons of Mora Cooperative Creamery has been calculated on a feed-year basis - that is, from June 1 through May 31. Similarly, prices received by this group each month have been averaged on the same annual basis.

It is brought out clearly by figure 5 that there is no close relationship between feed production and butterfat production based on a year-to-year comparison, although the relationship tends to be closer when poor crops follow each other in succession for a series of years like the crops from 1929 to 1934. The low feed production in 1934 was not accompanied by a corresponding fall in butterfat production undoubtedly because of emergency arrangements like Government feed loans.

The swing in production of feed is about as large as the swing in butterfat prices. Butterfat production on the other hand fluctuates relatively moderately.

The downward swing of butterfat production from 1929, especially from 1932 to 1934, was probably a response to a decline in feed production and, to a minor extent, a response to low prices of butterfat and other farm products.

Further light is thrown on these relationships by examining individual responses of dairy farmers in the Mora community.

PRODUCTION RESPONSES BY INDIVIDUAL PRODUCERS

A more detailed study of variations in production in the Mora community is now in order. The names of 150 patrons of the Mora Cooperative Creamery were selected from the creamery-payment records on the basis of their having been continuous and exclusive patrons of this creamery for the last 10 years. Next, a record was obtained of the monthly and annual sales of butterfat by each of these patrons for the period from June 1927 through December 1937. Later in the analysis, 20 of these patrons were eliminated because of errors in or incompleteness of their records, leaving a group of 130 individuals with reliable annual records. The monthly data for 30 of these were not available so only 100 records with complete monthly data could be obtained (fig. 5).

In June 1938, 62 of the 130 farmers were interviewed. In the analysis of the records thus obtained, 8 were eliminated because of incompleteness and unreliability, leaving a group of 54 farmer-interview records.

In figure 6, the annual sales of butterfat are shown for the group of 54 interviewed patrons, the 100 farmers for whom there are reliable monthly and annual records, and the 130 farmers for whom there are reliable annual records. On this chart are also shown the total annual quantities of

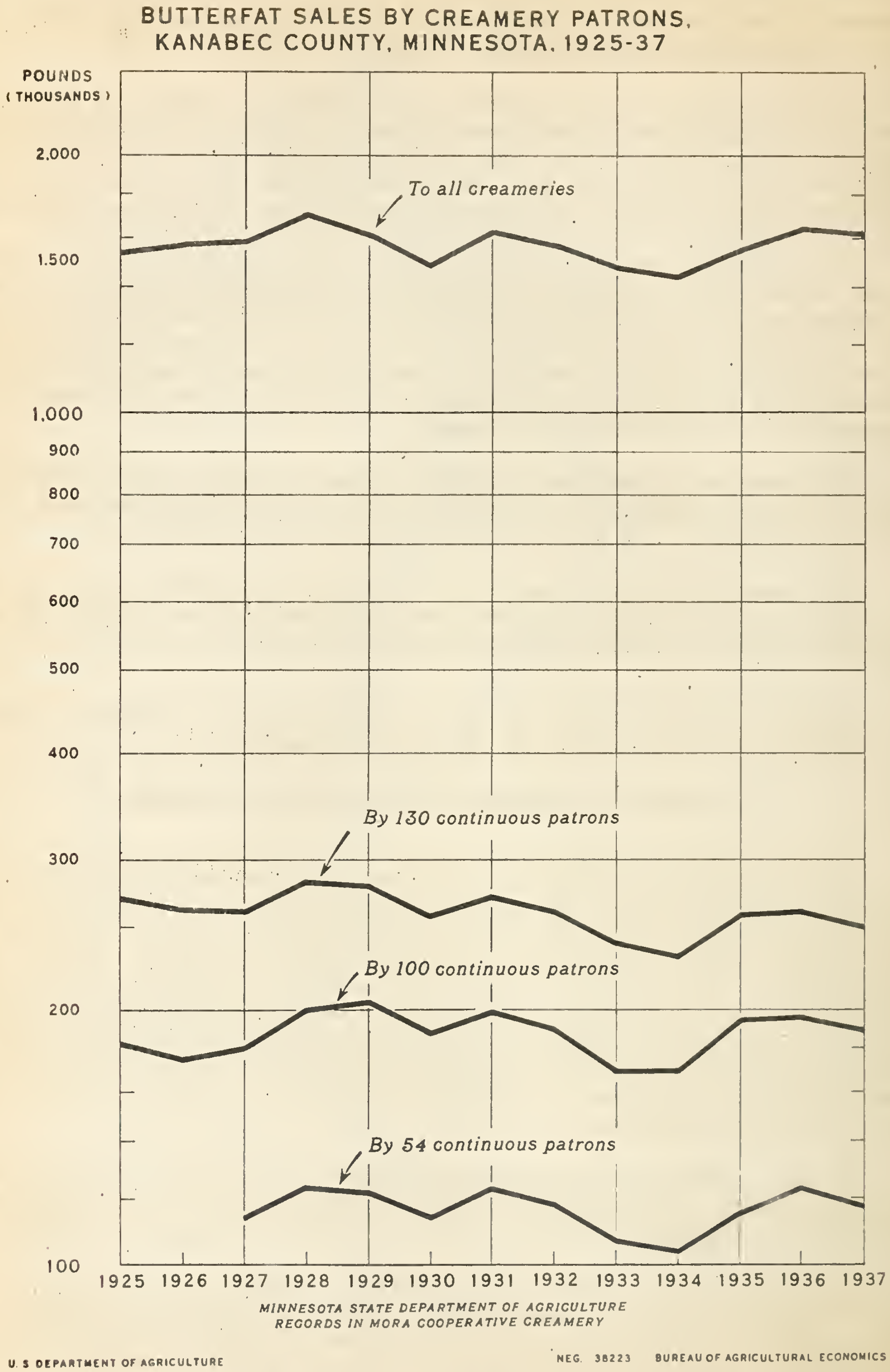


Fig. 6.- Butterfat sales by creamery patrons, Kanabec County, Minnesota, 1925-37.

butterfat sold to all creameries in the county. 6/

A comparison of the commercial butterfat production by calendar years for the periods indicated for Kanabec County and groups of producers in the Mora community reveals that the general movement of all series is parallel, although some of the percentage changes from year to year tend to be slightly larger for the producer groups than for the county as a whole. The importance of these comparisons is in the indication that fluctuations in annual butterfat production of the particular group studied is a satisfactory sample of larger groups in the same community and of the county as a whole.

Having studied the aggregate changes in production for the community and for the several groups of continuous records, an examination is next made of individual producers' responses. The 130 continuous annual records were sorted into township groups so that key men in each township could be consulted about each individual producer. Information about size of herd, tenure status, age of operator, family labor, supplementary enterprises, indebtedness, and personal characteristics of each producer, was obtained as the basis for the selection of the 60 odd producers to be interviewed.

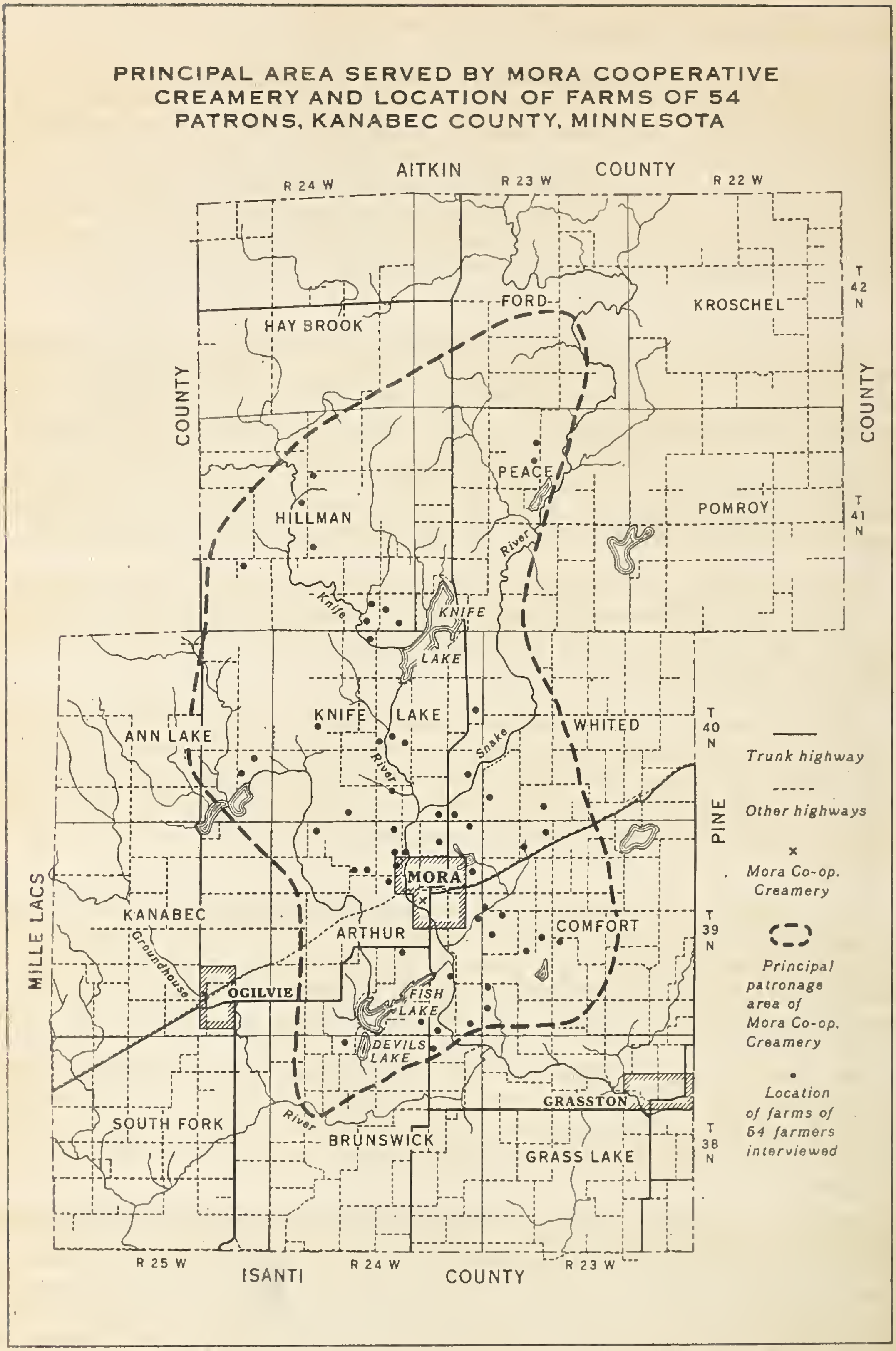
The interviews were conducted on an informal basis. Each farmer was shown a chart of his butterfat production for 1927-37, and he was encouraged to give his explanation of the annual changes. This information was later arranged on a schedule.

Data on number of cows and other cattle for each of the interviewed farmers were obtained from the county assessor's records for the period 1927-37. These were used to supplement the individual producers' estimates of number of cows. From the Kanabec County Agricultural Conservation Committee the number of acres of each class of land operated by each producer in 1937 was learned.

The location of the producers who were interviewed and whose records were used is shown in figure 7. An examination of the individual charts of butterfat production for the 54 farmers for the period 1927-37 reveals such a diversity of response that a case approach would seem most applicable. However, the statistical method was also used to some extent in the analysis.

The records were sorted into six trend groups on the basis of the level of production in the 3 years 1935-37 compared with the 3 years 1927-29. This procedure may not always give an adequate picture of the trend, but in most cases it will coincide closely with a more exact statistical determination.

6/ It should be pointed out that a record of butterfat sales to a given creamery is less likely to represent the production of butterfat in an area than is a record of total sales to all creameries in the area, or a record of the total sales by a group of continuous and exclusive patrons. The factor of change in volume of business because of competition between creameries, and the gain or loss in patronage, enters the consideration when records of a single creamery are used.



PRINCIPAL AREA SERVED BY MORA COOPERATIVE CREAMERY AND LOCATION OF FARMS OF 54 PATRONS, KANABEC COUNTY, MINNESOTA

U. S. DEPARTMENT OF AGRICULTURE NEG. 38224 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 7.- Principal area served by Mora cooperative creamery and location of farms of 54 patrons, Kanabec County, Minnesota.

Each trend group was compared with certain characteristics of the operator and his farm organization in the period 1927-37. After the methods of adjustment in each trend group had been studied, an analysis was made of the reasons for these adjustments by the various groups.

The basis on which the six groups are classified and the number of farms in each group are given in table 11.

Table 11.- Basis of sorting and number of farms in each trend group, 1927-37

Basis of sorting	Number of farms
	Number
Upward trend - production in 1935-37 higher than in 1927-29:	
I. More than 33-1/3% - decidedly upward..........	8
II. 10% to 33-1/3% - upward....................	12
III. Less than 10% - slightly upward...........	4
Total	24
Downward trend - production in 1935-37 lower than in 1927-29:	
IV. Less than 10% - slightly downward.........	10
V. 10% to 33-1/3% - downward..................	16
VI. More than 33-1/3% - decidedly downward........	4
Total	30

It is interesting to find that if a "no trend group" is set up by combining groups III and IV, the total number of farms with upward trend is equal to the number of farms with downward trend. The total butterfat sales by the 54 farmers and butterfat sales by groups are shown in figure 8.

The distribution of all the farms studied with respect to whether they increased, decreased, or did not significantly change their production in any one year compared with the immediately preceding year, is shown in table 12.

Table 12. - Distribution of farms by type of change in butterfat production each year, 1928-37

Type of change	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Increase....	37	26	16	34	19	11	20	34	29	12
No change...	3	6	7	3	5	5	7	2	6	13
Decrease....	14	22	31	17	30	38	27	18	19	29

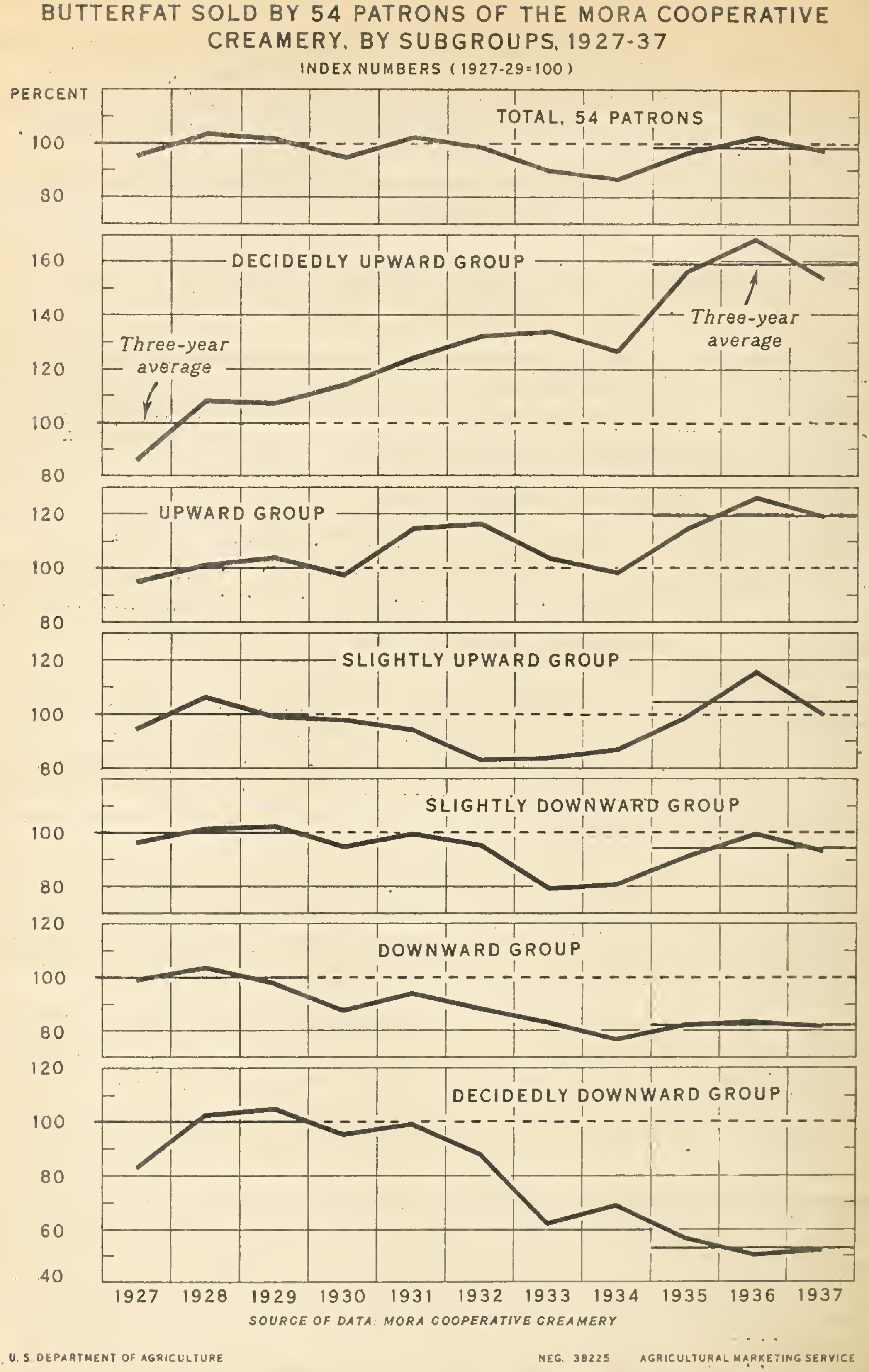


Fig. 8.- Butterfat sold by 54 patrons of the Mora cooperative creamery, by subgroups, 1927-37.

The nearest approach to unanimity in direction of movement occurred in 1928 and in 1933. The table illustrates how diverse the individual responses are. Distributions for each of the trend groups present a picture substantially the same as for the total number of farms. There is scarcely a single year in any group in which there was unanimity in the direction of response.

Relationships Between Types of Trend and Farm Organization and Operation, 1927-37

After the records were sorted into six trend groups, the next task was to study the relationships between changes in production of butterfat and changes in farm organization and practices. The farm organization and practices prevailing at the end of the period are matters of record. Even for the earlier part, the general direction of change is known, although the farm organization cannot be described in detail.

It may be helpful to examine the geographical distribution of records within Kanabec County indicated in figure 7 and table 13.

Table 13.- Distribution of farms by townships and trend groups

Township	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Peace............	1	-	-	-	-	1	2
Hillman..........	1	1	1	2	3	-	8
Ann Lake.........	1	1	-	-	-	-	2
Knife Lake.......	3	1	1	3	3	-	11
Whited...........		2	-	-	-	-	2
Comfort..........	1	3	1	1	3	1	10
Arthur...........	1	4	1	3	6	2	17
Brunswick........	-	-	-	1	1	-	2
Total........	8	12	4	10	16	4	54

The northern townships are the more recently settled. The farms in townships like Peace, Hillman, and Knife Lake have a smaller proportion of farm land in crops than have the townships farther to the south. Likewise the same townships, because of the character of the land, are less subject to drought than are the southern townships.

Available labor

The operator's age and the amount of family labor are factors affecting the available labor supply. Distribution of farms by ages of operators is shown in table 14.

Table 14. - Distribution of farms by ages of operators and trend groups

Age intervals	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
30-39	-	3	3	1	1	-	8
40-49	4	3	-	2	2	-	11
50-59	3	4	1	5	10	1	24
60-69	1	2	-	-	3	3	9
70-79	-	-	-	2	-	-	2
Total	8	12	4	10	16	4	54
Average age	53	48	42	54	55	60	52

This table shows that the ages of operators are rather widely scattered although there is a slight tendency for advancing age to be associated with a trend toward lower production. Owing to the small number of cases involved, the relationship is suggestive rather than conclusive. If all the cases having an upward trend are combined, the average age is 49 years as compared with 55 years for those with a downward trend.

The age of the operator becomes more significant when seen in relation to changes in available labor as indicated by table 15.

Table 15.- Distribution of farms by types of changes in family labor, 1935-37, compared with 1927-29, and trend groups

Type of change in family labor	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Increase	5	2	0	3	0	0	10
No change	3	10	4	6	6	2	31
Decrease	0	0	0	1	10	2	13
Total	8	12	4	10	16	4	54

The producers falling in group III, averaging 42 years of age, show no increase in family labor. They were either single or had young children who had not become of any help during the period. In group II, where the farmers averaged 48 years, there were only two cases in which there was a definite increase in family labor. Most were operators whose children were too young to help or who had no children. In group I, with an average age of 53 years, only three cases had no increase in family labor. The other farmers in this group were men in the prime of life who had grown children to help on the farm.

In the downward-trend groups, IV, V, and VI, the supply of labor decreased during the period as young people left the farm. Although labor was hired in a few cases, changes in all labor were about equal to changes in family labor.

Land resources and operation, 1927-37

Distribution of size of farms in terms of total farm land operated at end of the period is shown in table 16.

Table 16.- Distribution of farms by acres of farm land, 1937, and by trend groups, and average size of farm by trend groups

Size classes (acres)	Trend in butterfat production						
	Upward			Downward			Total
	I	II	III	IV	V	VI	
40-79	-	3	-	2	1	1	7
80-119	2	2	1	4	6	2	17
120-159	3	3	-	1	4	-	11
160-199	2	1	2	2	4	1	12
200-239	1	1	1	-	-	-	3
240-279	-	-	-	-	-	-	-
280-319	-	1	-	-	-	-	1
320 and above	-	1	-	1	1	-	3
Total	8	12	4	10	16	4	54
Average size	138	162	164	136	127	113	140

This table indicates that the farmers in the upward-trend groups operated farms of a larger size in 1937 than those in the downward-trend groups. If the average size of farm in each group is compared with average age of operators in each group as given in the previous table, there appears a tendency for the higher ages to be associated with smaller farms. Ten farmers reported that they were renting land and operating it jointly with their own land. Only two of these farmers fall in the downward group, IV; the rest fall in the upward-trend groups - two in I, five in II, and one in III.

Changes in farm land operated during the period are indicated in table 17.

Table 17.- Distribution of farms by types of changes in size of farm operated and trend groups

Type of change in size of farm	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Increase	3	6	1	0	1	0	11
No change	5	6	3	10	15	3	42
Decrease	0	0	0	0	0	1	1
Total	8	12	4	10	16	4	54

Only 12 out of the 54 farms changed in size at all during the period 1927-37. Only one farm decreased in acreage. Nearly all the farms that increased in size were farms whose production of butterfat tended upward.

The acreage in crops has increased, and these increases have largely fallen in those groups in which production tended upward during the period (table 18). By calculating the proportion of total farm land in crops at the end of the period, it was found that group I, in which production increased the most, had the smallest proportion of land in crops. While the proportion was only 34.4 percent in this group, it varied between 41.3 percent and 52.6 percent in the other groups. The reason for the relatively low acreage of crops in group I is the recent date of settling of several farms in this group.

Table 18.- Distribution of farms by types of changes in cropland and trend groups, 1927-37

Type of change in cropland	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Increase	5	2	2	1	1	0	11
No change	3	10	2	9	15	3	42
Decrease	0	0	0	0	0	1	1
Total	8	12	4	10	16	4	54

The changes that have taken place in the cropping program during the period consist as a whole in a concentration on the raising of more feed for dairy cattle. Seven farmers reported a decrease in potato acreage. They are distributed through all trend groups except IV and VI. It is suggested, therefore, that a release of acreage from potato production has been one of the factors contributing to increasing trends in production of butterfat.

Alfalfa is grown on most of the farms. On a few farms it cannot be successfully grown because of hardpan or inadequate drainage. The proportion of cropland in alfalfa averaged around 20 percent for all except group VI where it was only 9 percent. By counting the farms in the various groups which either started or increased their alfalfa acreage during the period, it was found that these cases were distributed through both the upward- and downward-trend groups. Growing of Reed canary grass has also made progress.

The dairy enterprise, 1927-37

Estimates of the number of cows kept each year during the 10-year period were obtained. By supplementing this information with the data on cow numbers collected from the county auditor's records, it was possible to arrive at the number of cows kept at the beginning as well as at the end of the period 1927-37.

The number of farms in each size and trend group at the end of the period is shown in table 19.

Table 19.- Distribution of farms by number of cows, 1937, and by trends in butterfat production, 1927-37, and average number of cows by trend groups, 1937

Number of cows	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
5- 9	2	2	1	5	4	4	18
10-14	4	7	-	3	9	-	23
15-19	2	1	2	1	3	-	9
20-24	-	1	1	1	-	-	3
25-29	-	1	-	-	-	-	1
Total	8	12	4	10	16	4	54
Average number of cows	11.5	13.3	17.2	10.6	10.9	6.0	11.6

In the downward-trend groups as a whole the average number per farm was 10.1, compared with 13.7 in the upward groups. Although the classification indicates that there are exceptions, the herds that are now larger are generally owned by farmers who have increased their production of butterfat, while the smaller herds are generally owned by farmers who have decreased their production. In table 20 the average size of herd in each group at the beginning and end of the period 1927-37 is indicated.

Table 20.- Average number of cows by trend groups at the beginning and end of 1927-37

Time 1927-37	Trend in butterfat production					
	Upward			Downward		
	I	II	III	IV	V	VI
Beginning	7.6	11.6	17.2	9.6	11.8	9.2
End	11.5	13.3	17.2	10.6	10.9	6.0
Change	+3.9	+1.7	0	+1.0	-.9	-3.2

As would be expected, the greatest change in cow numbers took place where the change in butterfat production was the greatest. Furthermore, the relationship between number of cows at the beginning of the period and the trend is somewhat different than the relationship between the number at the end of the period and trend.

It is worth while to note how many farms in each trend group had changed cow numbers. The end of the period 1927-37 is again compared with the beginning of the period, leaving aside intervening changes.

Table 21.- Distribution of farms by type of change in number of cows and by trend groups, 1927-37

Type of change in number of cows	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Increase	7	9	0	1	0	0	17
No change	1	3	4	7	5	0	20
Decrease	0	0	0	2	11	4	17
Total	8	12	4	10	16	4	54

It is definitely shown by table 21 that many farmers did not change their numbers of cows although their production of butterfat did change.

Only four farmers of the total number interviewed referred to changes in the quality of cows as being one of the reasons contributing to trends in butterfat production. Three of these men said that the quality of their cows had improved during the period; all showed an upward trend. One farmer said that the quality of his cows had decreased; his trend was downward. Although changes in the quality of cows may have been an influence in more cases than the interviewed farmers thought, the indications are that improvement in the quality of cows was not a significant factor during the period 1927-37.

Six of the intereviewed farmers attributed change in output per cow to changes in the rate of feeding. They indicated that the level of feeding was lower at the end of the period than at the beginning. All six were in the downward-trend groups. It is probable that changes in feeding practices have been very common. Comparison with other data on purchase of concentrates and changes in the cropping system would suggest that the tendency during this period has been in the direction of more and better quality roughage and less concentrates in the ration.

A comparison of the level of butterfat production and cow numbers in 1935-37 with 1927-29 (figs. 8 and 9), indicates that butterfat production has risen relatively more than the cow numbers for all the upward-trend groups. The downward groups are not so consistent. Group IV is odd in this respect, partly because of the inclusion of some beef cattle; the number of cows has risen but the butterfat output has fallen. In group V the decline in butterfat production is relatively larger than the decrease in cow numbers; in group VI the reverse is true.

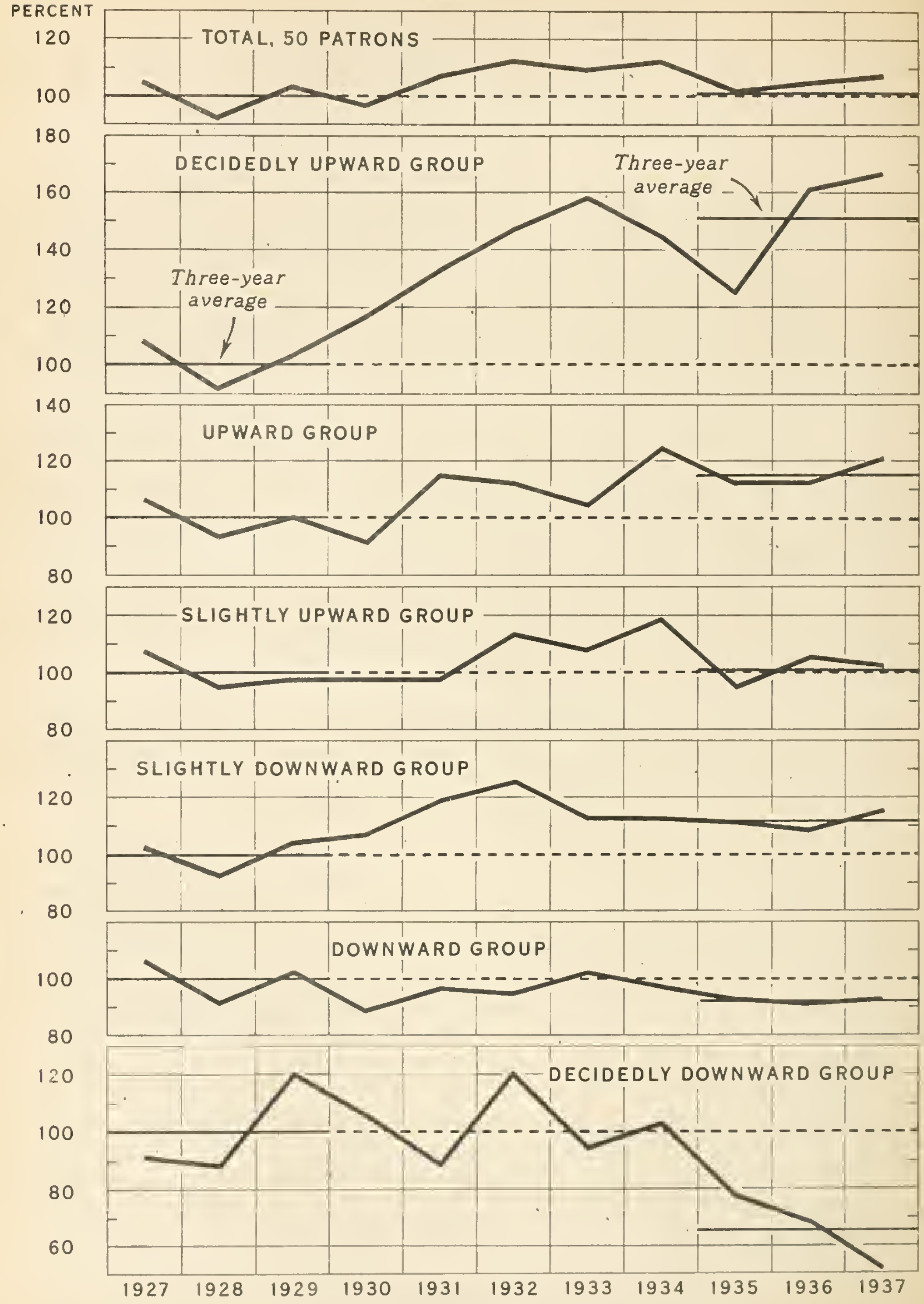
It is, of course, not expected that trends in cow numbers and butterfat production would be identical. Quality of cows, rate of feeding, disposition of the milk, and the fact that for each successive cow added to a herd a larger proportion of the production becomes commercially available, must be considered.

It is important to note that, although the net effect of the divergent behavior in the groups has been that cow numbers have increased, butterfat production has decreased slightly.

Annual changes in butterfat production and cow numbers for the period can most profitably be studied in relation to home-grown feed supply and butterfat prices, which in turn are responsible for the degree to which home-grown feed shortages are supplemented by feed purchases.

In 1928, for instance, crops were exceptionally good and butterfat prices were high. It was the number of cows that limited production that year. The rate of feeding and output per cow were high, more than offsetting the decline in numbers compared with 1927. In 1929, on the other hand, feed supplies, rather than number of cows, limited the production. In 1930, the number of cows declined, but feed supplies were also lower than in 1928. In 1931 a recovery took place in number of cows and feed production, resulting in more butterfat. Generally speaking, feed supplies limited production during the years 1932-34 rather than number of cows. Butterfat prices were low both absolutely and relative to feed prices during this period, and home-grown feed shortages were not adequately offset. The recovery in feed production in 1935, 1937 and 1938 was accompanied by a less marked recovery in the number of cows which had been considerably reduced on account of the drought in 1934.

In contrast to the increase in numbers of cows, the numbers of other cattle kept on the 54 farms during the period 1935-37 relative to 1927-29, have declined (fig. 10). This conclusion holds for all groups except group III.



NUMBER OF COWS KEPT BY 50 PATRONS OF THE MORA COOPERATIVE CREAMERY, BY SUBGROUPS, MAY 1, 1927-37

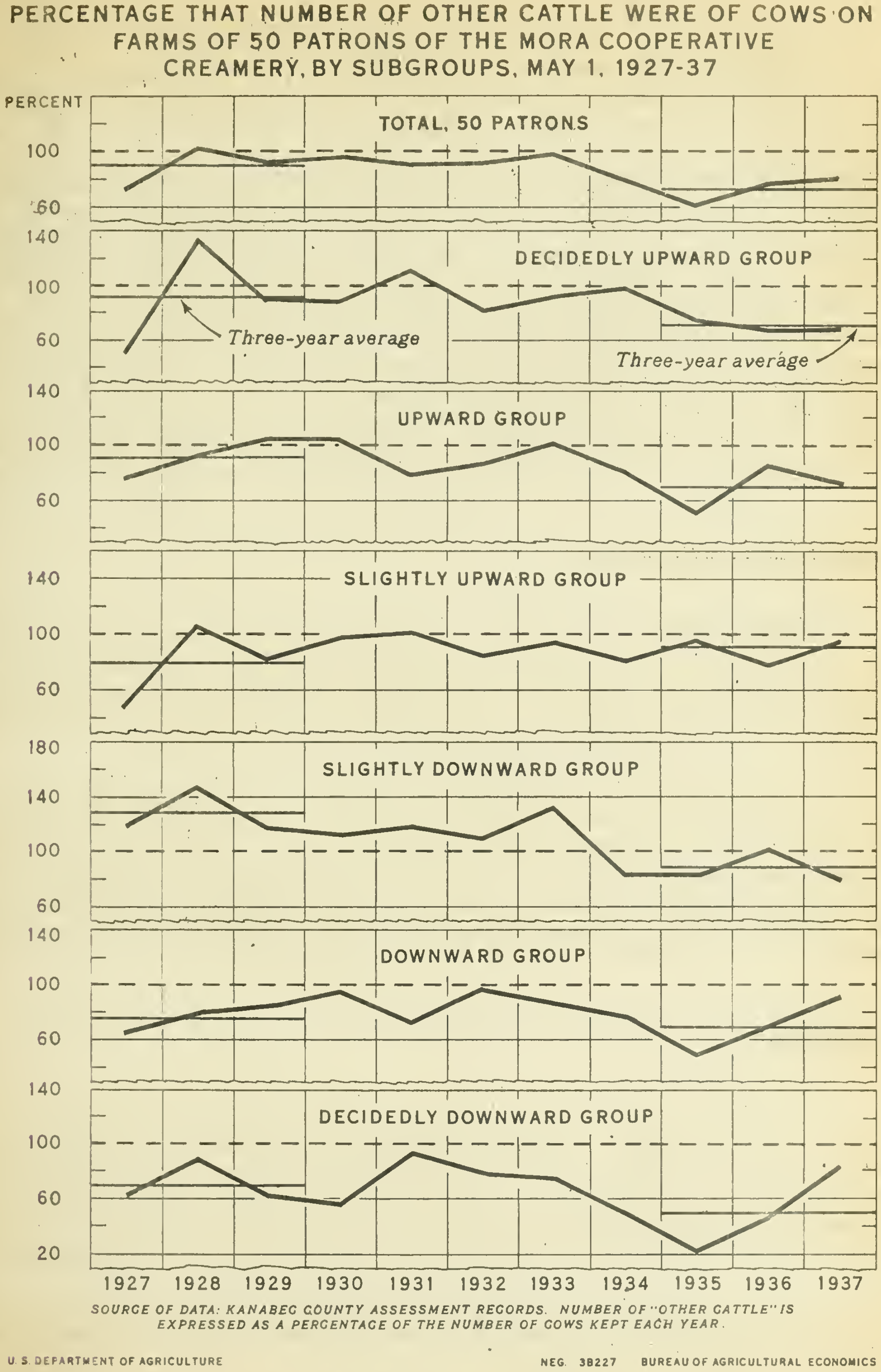
INDEX NUMBERS (1927-29=100)

SOURCE OF DATA: KANABEC COUNTY ASSESSMENT RECORDS

U. S DEPARTMENT OF AGRICULTURE

NEG. 38226 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 9.- Number of cows kept by 50 patrons of the Mora cooperative creamery, by subgroups, May 1, 1927-37.



PERCENTAGE THAT NUMBER OF OTHER CATTLE WERE OF COWS ON FARMS OF 50 PATRONS OF THE MORA COOPERATIVE CREAMERY, BY SUBGROUPS, MAY 1, 1927-37

SOURCE OF DATA: KANABEC COUNTY ASSESSMENT RECORDS. NUMBER OF "OTHER CATTLE" IS EXPRESSED AS A PERCENTAGE OF THE NUMBER OF COWS KEPT EACH YEAR.

Fig. 10.- Percentage that number of other cattle were of cows on farms of 50 patrons of the Mora cooperative creamery, by subgroups, May 1, 1927-37.

Some of these changes are permanent; others are cyclical. Other cattle includes beef cattle and young stock for replacement of dairy cows. The inclusion of beef cattle is particularly evident in group IV. Although there are only a few farms on which beef cattle have been of any consequence during the period, the trend has been to reduce beef-cattle numbers in favor of dairy cows. Although the variation between groups was rather large, there was, as a net effect, no large change in the proportion of young stock to cows between 1928 and 1933. The number of young stock declined rapidly during the years 1933 and 1934 (registered in the spring of 1934 and 1935), but recovered some of the decline toward the end of the period. The reduction in young stock that was undertaken during the drought years disrupted the normal process of replacement. It will be several years before the number of replacements assumes its normal ratio to the number of cows. By reducing young stock, the proportion of feed supplies fed to dairy cows was increased during the drought period. This fact emphasizes the flexibility of other enterprises in relation to butterfat production.

Supplementary enterprises

Supplementary enterprises of minor commercial importance existed on 42 of the farms. These include potatoes, poultry, hogs, sheep, and some outside work. These farms are distributed through all trend groups, indicating that there is little relationship between trends in productien and supplementary enterprises or changes in those enterprises.

No increases in the acreage of potatoes or in the number of beef cattle were reported by the farmers interviewed. With respect to hogs, poultry, and sheep, some farmers reported decreases while others reported increases in the number kept. The net effects for the group were a decrease in hogs and poultry and an increase in sheep. Supplementary enterprises as a whole have undergone some changes during the period 1927-37, the net effect of which is a concentration of the dairy enterprise.

Indebtedness

Information about the financial status of the eperator was obtained on 48 of the 54 farms. All the interviewed farmers were owners of their farms. Twenty farmers reported indebtedness on the real estate alone, on real estate and chattels, or on personal notes. The comparatively low ratio of indebted farmers results partly from the restricted method of sampling, requiring the same operator and the same farm for the entire period.

There does not seem to be any relationship between indebtedness at the end of the period or changes in indebtedness during the period and trend groups in butterfat production.

We have traced the relationships between types of response for the period 1927-37 as exemplified by trend groups and (1) characteristics of operator and farm organization at the end of the period, and (2) the methods bringing about the changes in butterfat production.

It can be concluded from this analysis that age of operator and family labor, size of herd, and land resources operated, are factors which account for differences in response. Other factors - like supplementary enterprises and indebtedness - are unrelated to response except, of course, in individual cases.

Generally speaking, increasing production was more frequently brought about by relatively young men who had some increase in family labor during the period, some increase in land operated, and increases in size of herd. The groups whose production have decreased consist of relatively older men with decreases in family labor and with a decline in size of herd but not in land operated. Consequently, in the upward-trend groups all the factors of production were probably utilized to a fuller extent at the end of the period, while in the downward-trend groups labor was the limiting factor and there was more land per cow than at the begining of the period.

The net changes of all groups point to increases in the capacity to produce butterfat, which is capable of asserting itself provided normal yields are obtained and dairy herds are built up.

Trends in Butterfat Production Related to Factors Common to all Farms

It appears from the foregoing analysis that the 54 farmers classified into various trend groups employed various methods of adjustment during the period 1927-37. What are the causes of these adjustments? Since the responses are so diverse and the external factors are substantially the same, have external factors no influence?

The next step is to see whether external factors like butterfat prices and crop and pasture conditions have influenced trends in production.

Trends in butterfat production and butterfat prices

Butterfat prices were 31 percent lower during the period 1935-37 than in the period 1927-29. The price dropped to a much lower level during 1932-33. In fact, the percentage decline in butterfat prices from 1927-29 to 1932-33 was 56 percent. For other farm commodities like hogs, cattle, sheep, chickens, and eggs, it appears that the decline ranged between 50 and 63 percent between 1927-29 and 1932-33. From the point of view of relative prices there does not appear to have been any incentive to engage in other lines of production. On the other hand, there is no doubt that generally low prices did have an adverse effect on production.

On the cost side, as enterprises like hogs and poultry are partly dependent upon purchased feed, and as feed for these enterprises became scarce because of protracted drought, the net result was an encouragement of dairying since this enterprise could be carried on to a larger degree on home-grown feed.

To learn the sensitiveness to price changes, it is important to know to what extent farmers are relying on outside sources for part of their feed supply for milk cows. Sixteen farmers out of the 54 reported that they regularly purchased grain; the rest of the farmers either did not buy at all or bought only exceptionally. It does not appear that there is any relationship between the practice of buying grain and trends in production.

In response to the question of whether or not butterfat prices had any effect on butterfat production, 16 farmers answered affirmatively. It should be noted that this group is not the same as the above group which reported regular grain purchases. Some farmers in the latter category reported that it was not practicable to change the rate of feeding with changes in prices. One farmer, who regularly used only home-grown feed, reported that he altered the rate of feeding with prices; that is, if the feed was at hand the rate of feeding was stepped up when prices of butterfat were high.

The various methods of response to changes in butterfat prices as reported are summarized in table 22. Some farmers reported several methods of response while others reported only one.

Table 22. - Number of times that designated methods of response to changes in butterfat prices were mentioned among 16 of the 54 interviewed farmers

Method of response	Number of times mentioned
Varying grain purchases (rate of feeding) with changes in relation between butterfat prices and grain prices............................	13
Varying care of cows	3
Varying number of cows	1
Varying rate of feeding of home-grown feed................................	1
Changing from dairying to other enterprises when butterfat prices are low	2
Fewer cows if butterfat prices are high	1
Total	21

Judging from this summary, the butterfat-feed price ratio is important. As shown by table 23, the butterfat-feed price ratio declined steadily throughout the period 1925-37 in sympathy with a decline in dairy ration purchased.

Inadequate or no data at all are available on quantities of feed purchased by farmers. Such purchases are, as far as can be learned, of minor consequence compared with home production of feeds, although they may be of some importance for a particular year. The home production of roughage relative to grain does not remain fixed but varies in the short run. A proper relation between these two classes of feed in the dairy ration has bearing on changes in butterfat production from year to year.

Referring to previous analysis of variation in yields of feed crops, feed production and butterfat production (figs. 3 and 5) one indication of feed purchases is presented in table 23.

Table 23.- Ratio of butterfat price to feed price, Mora, Minnesota, 1925-37

Year	Average annual price of dairy ration per cwt. 1/	Average annual price of butterfat per pound	Butterfat-feed price ratio	Quantity of dairy ration (100 lbs.) 2/	Quantity of mixed feed (100 lbs.) 2/
	Dollars	Dollars			
1925	1.79	0.487	27.2	---	--
1926	1.77	.486	27.4	---	--
1927	1.93	.525	27.2	5,842	8,109
1928	2.11	.537	25.4	9,148	12,992
1929	2.00	.500	25.0	5,425	9,311
1930	1.76	.391	22.2	5,253	14,297
1931	1.33	.289	21.7	2,298	10,163
1932	1.10	.211	19.2	5,741	13,117
1933	1.13	.223	19.7	2,513	9,222
1934	1.42	.278	19.6	3,370	11,628
1935	1.67	.319	19.1	4,374	17,589
1936	1.63	.372	22.8	3,351	16,286
1937	2.21	.381	17.2	2,794	12,705

1/ Prices directly from Mora Cooperative Creamery for the years 1933-36; they are calculated for the other years from price series of the constituents of the ration.

2/ Sales by the feed department of the Mora Cooperative Creamery.

The feed department of the Mora Cooperative Creamery is only one source of supply for the farmers in this community, so these sales of feed should be thought of merely as an indication of the relative quantities bought from year to year in this community. The purchases of dairy-ration feed are of direct importance in supplementing home-grown supplies for dairy cows; the sales of mixed feed for other livestock are of indirect importance, because their use generally results in saving more of the home-grown feeds for the dairy herd.

Examination of records of feed sales kept by the feed department of the Mora Cooperative Creamery revealed that by far the heaviest purchases of dairy-ration feed in the period 1927-37 were made during the first 4 months of the year. March was the month of largest purchases, April ranked second, February third, and January fourth. This indicates that purchases of feed are generally not made until home-grown supplies are practically used up - farmers do not buy feed until they must. About four-fifths of the dairy-ration feed sold to farmers in 1932 was bought by them during the first 5 months of the year, and therefore became part of the feed supply of the feed year ending May 31, and contributed to the butterfat production of that period (fig. 5).

The largest purchases of mixed feeds were made in years following those of relatively small crops of oats and barley, with smaller purchases following the years of better crop yields. But in 1933 and 1934, purchases of feed were small in spite of short crops, for farmers could not afford to buy feed even though prices were low - butterfat prices were also very low and the price relationship was especially unfavorable in 1934. Hay was bought in 1934 as the feed shortage was more acute in roughage than in grain. The high production of 1931-32 was probably influenced by using considerably larger quantities of purchased feeds than usual.

It should be emphasized that low prices for butterfat coincided with a low butterfat-feed price ratio and poor crop and pasture conditions due to drought. A combination of these unfavorable circumstances, apart from affecting the confidence of farmers, tended to make the butterfat production parallel the changes in home-grown feed, with the exception of the adjustments that could be made in the disposal of home-grown feed as a result of reducing young stock relatively more than cows.

Crop and pasture conditions

Crops and pastures were exceptionally good in 1927-28. They were generally poor from 1929 onward, owing to a succession of dry years, hail, and attacks by grasshoppers. The worst years were 1933 and 1934. Crop and pasture conditions were good in 1935, 1937, and 1938. By examining the charts for the 54 producers on the basis of a large or a small decline in production during the drought of 1933-34, it is possible to learn the effect on the trend for the period.

Table 24.- Distribution of farms having small or large declines in butterfat production, 1933-34

Type of effect	Trend in butterfat production						Total
	Upward			Downward			
	I	II	III	IV	V	VI	
Small	7	7	1	6	8	1	30
Large	1	5	3	4	8	3	24
Total	8	12	4	10	16	4	54

Table 24 shows that a larger number of the farms where the effect of the drought was heavy fell in downward-trend groups. This suggests that the drought either accelerated a downward tendency or was one of the major reasons for the low production in 1935-37 as compared with 1927-29.

Case-Farm Studies

The following section presents nine case-farm studies which are typical of significant individual changes that have taken place during the period 1927-37. These farms were selected to represent the different patterns of response within the trend groups. A representation is included of age of operator, family labor, land operated, cropping program, size of herd, supplementary enterprises, indebtedness, farming practices, psychological factors, and sundry other influences which either jointly or separately limit production and determine the course of response. The geographical location of farms within the county is also represented.

The distribution of case farms selected for this analysis by trend groups and the annual butterfat production for each producer for the period 1927-37 are shown in table 25. (See Appendix)

Mr. A

This case typifies an original settler, who with the aid of family labor broke more land and expanded his dairy enterprise until the end of the period when a certain level of butterfat production was attained.

Review of butterfat production, 1927-37

The production of butterfat was 1,000 pounds in 1927; it rose rapidly to 1,600 pounds in 1929, and more slowly to 2,300 pounds in 1935. The rise has apparently culminated, because production was the same in 1937. Excepting the years 1930, 1933, 1934, and 1936 the production in each year was larger than in the preceding year. The rising trend was interrupted during these 4 years.

Farm organization and operation, 1927-37

Mr. A was 51 years old in 1938. The farm family consists of the operator, his wife, one boy 20 years old, and three girls, two of whom are grown. The whole family has been employed on the farm. No outside labor has been hired nor has any member of the family worked off the farm. The changes in available labor that have occurred during the period have come as the children grew older. The operator is an able man and the cooperative relations within the family are very good.

Mr. A is the original settler on this farm. He bought 160 acres of wild land in 1923. There are now 36 acres of cropland. Some of it has been broken during the past 10 years. There are 10 acres of cleared pasture near the buildings. The remaining land consists of brush pasture. The topography is flat or slightly rolling. The soil is not so subject to drought as are some other farms in the community.

The crops grown are alfalfa, clover and timothy, corn for grain, and oats. During the last 10-year period, increases in cropland have overshadowed any changes in the cropping system.

The farm buildings, because rather new, are in good condition. The barn, built 8 years ago, has room for 12 cows and some young stock. The barn room was ample up to the end of the period, but now it is the factor that limits the dairy enterprise. In 1938, for instance, hay was sold standing because there was not room for the hay and additional cows, and hay was carried over from the 1937 crops.

Dairying is the commercial enterprise. Hogs and poultry are for household use only. There has been a constant increase in the number of cows. From 4 in 1927 the number rose to 8 or 9 in 1929, and increased to a number ranging from 10 to 12 during the period 1931-34. Twelve cows have been kept since 1935. Only home-grown feed was used for the cows.

The operator's financial position is very good. No debt of any kind was reported.

Evaluation of changes in butterfat production, 1927-37

The persistent change in butterfat production was caused by the operator and his family breaking more land and thus increasing the supply of feed, making it possible to keep more cows. The producer wanted to build up his dairy enterprise to a certain size. The increase in available labor as the children grew older has contributed toward this end. Although the growth in butterfat production, 1927-29, may have been encouraged by favorable prices, changes of prices for butterfat do not seem to have greatly affected production on this farm. The slump in production in 1930 was a response to unfavorable crop and pasture condition during that year and the preceding year. More cows were added to the herd in 1931, matching the increase in available feed. The period of progressively dry weather, culminating in the 1934 drought, acted to stop expansion rather than to decrease production materially. Cows were reduced in number in 1933 and 1934, but heifers were kept for replacement and expansion. When the 1935 crop and pasture conditions became more favorable, the number of cows rose to 12. The dip in 1936 was a reaction to unfavorable crops and pasture caused by the drought of the same year.

The chances are that butterfat production on this farm has now become established at a certain level. Barn space is the limiting factor. The operator has no present intention of enlarging the barn.

Mr. B

This case is typical of increasing family labor, changes in the cropping system, and improvement in cropping practices making more feed available for expansion of the dairy enterprise. The transition appears to have been completed.

Review of butterfat production, 1927-37

Although the butterfat production fluctuated between 1,400 and 1,800 pounds during the period 1927-34, there was no evidence of any trend in production: It increased to almost 2,900 pounds in 1935 and dropped back some the next 2 years. By 1937 one-half of the increase was cancelled.

Farm organization and operation, 1927-37

There are four members of the family - the operator, 49 years old in 1938, the wife, and two sons who are 18 and 21 years old. The farm family does all the work. Although Mrs. B used to work in the field before the sons grew up, the growing sons have more than offset her failure to continue such work.

Mr. B, who was raised on the neighboring farm which his father originally settled in 1881, bought this 200-acre farm 26 years ago. It had 90 acres of cropland, and there has been no change; no new land has been broken during the past 15 years.

The cropping program several years ago included 15 acres of potatoes. This crop has been gradually reduced, especially during the last 5 years of the period. In 1938 only 1 acre was grown. Alfalfa has been expanding continuously since Mr. B started growing it 15 years ago; 29 acres were in this crop in 1938. Usually 15 acres of silage corn have been raised, with oats the other major crop. The entire cropping system has been adjusted to the raising of feed for livestock.

The farm has a good set of buildings. Electricity was being installed at the time of the interview. Barn space is available for 18 cows and there is additional place for young stock. Four horses and a tractor are used for farm power.

Dairying is the major enterprise, supplemented by poultry and hogs. The poultry enterprise has remained practically at the same level (200 hens) for the past 10 years. The hog enterprise was doubled last year, compared with its usual size for the period of 2 brood sows and their pigs. The number of cows, fluctuating up to 15 and down to 9 during the period before 1935, rose to 18 that year. The same number was kept in 1938. Mr. B bought 7 heifer calves following the drought of 1934 when 2 cows and several heifers were sold.

It is the usual practice of this operator to feed what he grows. In case of severe shortage of feed, and if prices of butterfat are favorable, some feed may be bought.

Mr. B's financial position is very good. Land and chattels are unencumbered.

Evaluation of changes in butterfat production, 1927-37

The persistent change that made an increase in butterfat production possible was a shift of cropland out of potatoes into feed crops. At the same time there has been an improvement in crop practices, by the growing of more alfalfa. Increase of family labor has facilitated the expansion of the dairy enterprise.

The underlying changes in the capacity for dairy production were covered up by the drought and depression period 1929-34, but they became visible during 1935-37 as recovered crop yields increased and the supply of home-grown feed and the number of cows was expanded.

The decline in production in 1929-30 and 1934 was associated with short feed supplies. The fall production in 1934 was remarkably small compared with the severity of the drought. This illustrates the flexibility of the farm organization. Hardly any feed was bought, some swamp hay was cut, and late corn was planted; the herd was reduced, but in such a way that it replaced itself and expanded the next year. The decline in production in 1936 and particularly in 1937 was connected with the drought of 1936, intensified perhaps by irregularities with cows.

The dairy enterprise has expanded up to the limit of the barn. Mr. B intends to operate at this level. Increases in butterfat production may now be brought about by feeding and herd improvement practices rather than by changes in the number of cows.

Although the operator contended that he did not react to changes in butterfat prices, it appears that he estimated the net return would be increased by the shifts he has undertaken.

Mr. C

This case presents an example of a young man taking over a farm and expanding the dairy enterprise by better utilization of resources.

Review of butterfat production, 1927-37

The trend in butterfat production was upward throughout the entire period although it was interrupted in 1929-30 and 1933-34. Production fluctuated between 1,700 pounds in 1930 and 2,400 pounds in 1936.

Farm organization and operation, 1927-37

Mr. C was 40 years old in 1938. The family consists of Mr. and Mrs. C and one small child. Some labor is hired during haying season. There was no change in available labor during the 10-year period. A relative of the operator has his home on the farm but he usually works out. The operator worked off the farm to a considerable extent before he became a farm owner, and he has had some outside work throughout the period.

The operator's father settled on the place in 1898, starting from wild land. When the present owner took over the farm 10 years ago, it had 40 acres of cropland out of a total land area of 80 acres. No more cropland has been added. However, 40 acres of pasture land has been rented during the entire period. Although the rented land may not be needed in some years, it serves as a protection against unfavorable crop and pasture conditions. The land is generally low and possesses considerable drought resistance.

The cropping program, including hay crops like alsike, sweet clover, timothy, Reed canary grass, corn for silage, and oats, has not been changed to any material degree during the 10 years.

The farm buildings, excepting for paint, are in good condition. There is room for 14 cows in the barn.

Dairying is the sole commercial enterprise. The number of cows kept has usually varied from 10 to 12 but has been as high as 14 during recent years. Although some poultry and hogs are kept they are minor enterprises. Purchase of feed is exceptional.

The operator's financial position is fair. The land is mortgaged and some money is owed to a local bank.

Evaluation of changes in butterfat production, 1927-37

The upward trend in butterfat production during the period was accomplished by a better utilization of resources rather than the addition of more resources. The age and ability of the operator have favored this trend. Indebtedness has retarded the rate at which he has built up his dairy enterprise.

The low production in 1927 was probably associated with poor crop production the previous year. The drop in 1930 came because cows were sold to get money to pay on the farm debt. The fall in production in 1933 and 1934 was caused by unfavorable crop and pasture conditions. The drop in 1937 was due mainly to irregularities with replacing cows. Mr. C pointed out that the quantity of feed, its composition of grain and roughage, and the number and condition of the cows were the main factors. The limiting factors are fairly well matched on this farm. It is not probable that the production of butterfat will increase materially.

Mr. D

Mr. D is an example of a farmer with family labor who increased the dairy enterprise during depression and drought years by buying more land.

Review of butterfat production, 1927-37

The butterfat production showed no particular trend up to 1931. It fluctuated around 2,800 pounds. The production rose suddenly to 3,600 pounds in 1932. Since then, production has tended downward. It was 3,100 pounds in 1937.

Farm organization and operation, 1927-37

Mr. D was 56 years old in 1938. The family consists of Mr. and Mrs. D and a son who was 30 years old. The son has been living at home; there has been no change in available labor during the period.

The land has been cleared and broken by Mr. D, who began operating the place in 1907. The home farm consists of 120 acres, of which 100 acres are cropland. Some new land has been broken during the last 10 years. Forty acres of timber are owned in the neighboring township. In addition, the son bought 40 acres in 1932, of which 20 acres are cropland. The crops from this land were merged with those from the home farm during 1932-36. Since 1936 the son has sold his own crops for cash.

The cropping program consists of raising feed for dairy cattle. The main hay crop is clover and timothy; silage corn and small grain are also raised. Apparently the cropping program, apart from increases in land operated since 1932, has not changed much.

The buildings are in good order. The barn has stalls for 14 cows and additional room for young stock.

The number of cows kept was increased in 1932 as a number of heifers freshened. The number of cows was around 12 before 1932 and has been about 14 since then.

Mr. D operates a rather large poultry business, and his hog enterprise also assumes commercial importance.

Mr. D's financial position is very good. There is no indebtedness.

Evaluation of changes in butterfat production, 1927-37

The fundamental change on this farm is an increase in size, making it possible to expand the dairy enterprise. While the addition of land enabled an increase in production up to the capacity of the barn during the depression and drought years, the return of better crop yields and pasture conditions released crops on the newly added land for cash disposal. Although the son formally owns the added land, for practical purposes it is part of the same farm. The purchase of land took place at a time of low prices of butterfat, suggesting that it was an adjustment to expand the volume of business as an offset to lower prices.

The course of crop yields and pasture condition has affected the annual variation. The fall in production in 1929 was in response to unfavorable crop production. The rise in 1932 was due to an increase in cows - several heifers became fresh - and to larger land area, both cropland and pasture. The decline in production since 1932 was caused by a decline in the production per cow, other than reduction in the number of cows.

On this farm the capacity to produce has been enhanced, but the lack of barn space does not permit the use of the added capacity.

Messrs. E

This is a farm operated by two brothers on which butterfat production is fairly well stabilized. The farm is responsive to changes in crop and pasture conditions as no feed is bought. It brings out the timing of the two factors - feed supplies and number of cows.

Review of butterfat production, 1927-37

Excepting the period 1932-35, there has not been any great change in production during the period. Up to 1931, the production varied from

2,700 pounds to 3,000 pounds. It dropped to 2,000 pounds in 1934 but recovered quickly, reaching an all-period high of 3,100 pounds in 1936.

Farm organization and operation, 1927-37

The E brothers were about 35 years old and unmarried in 1938. Their mother keeps house. Their father was the original settler on the farm, beginning from wild land in the 1890's. Although he died in 1923, the brothers did not become owners until 1927. There has been no change in available labor during the period. The brothers do all the necessary farm work and exchange some labor during rush seasons with neighbors.

There are 160 acres of farm land. A forty, of which 22 acres are meadow, was bought in 1927. There are in all 80 acres of cropland, 10 acres of which have been broken during the past 10 years.

Half of the acreage is usually in small grain - oats or barley - and in fodder corn; the other half is in hay, mainly clover. Alfalfa is grown on a few acres only. Increase in cropland has been an important factor but it has been largely offset through other influences.

The farm buildings are in good condition. There is probably room for 20 cows in the barn.

This is a specialized dairy farm, although the breed of cows is of the dual-purpose type. Poultry and hogs are of minor importance. The number of cows kept was about 19 for the period 1927-31; it fell to 12 in 1934, but recovered to 19 in 1936 because freshening heifers replaced the cows lost by sales in 1934. The operator claimed that butterfat prices did not have any effect on butterfat production since he does not buy any feed.

The financial position is very good. There is no indebtedness on the farm.

Evaluation of changes in butterfat production, 1927-37

The outstanding characteristic is the maintenance of an even production except for decreases owing to lowered feed supply, resulting in a lower rate of feeding, or reduction in cow numbers, or both. Fall-freshening cows give a higher production than spring-freshening cows. The relative number of these affects annual output.

The farm is well organized. Production is brought to the limit of all the cooperating factors - labor, land, and buildings.

Although the crop yields and pasture condition varied during the period 1927-31, the production of butterfat varied very little owing to disposal changes of the feed supply by adjustment in the number of young stock relative to cows. Grasshoppers played havoc with crops in 1932. The drought of 1934 caused such a large curtailment in feed supply that several cows were sold. Shortages of feed affected output per cow. During the 1934 drought, cows were sold rather than young stock. It was this particular method, the conservation of young stock, which laid the foundation for the rapid recovery in 1935-37.

Mr. F

This case is typical of a man with a large supply of family labor who maintained his production of butterfat through 1932 in spite of low prices and poor crop and pasture conditions. But the coincidence of poor crops and low prices in 1933-34 caused production to be cut in half.

Review of butterfat production, 1927-37

The production of butterfat, which was 1,800 pounds in 1927, rose to 2,600 pounds in 1929. It remained at this level through 1932. It fell rapidly during the following 2 years down to 1,300 pounds in 1934. It had recovered to 2,400 pounds in 1935, but it declined to 1,600 pounds in 1937.

Farm organization and operation, 1927-37

Mr. F was 55 years old in 1938. The family consists of operator, wife, and five sons ranging from 15 to 27 years of age. No labor has been hired during the period. During the past few years, Mr. F had an outside job requiring his frequent attention. He is apparently a man of considerable ability.

Mr. F came to this farm in 1915. He was breaking land all the time up to 1929. He was operating 80 acres in 1927 when he rented an additional eighty which he bought after a few years, making his total farm 160 acres. There are about 50 acres of cropland; this has remained constant since 1929. In addition to owned land, 40 to 80 acres of wild land were rented during the recent drought period.

The cropping program has been geared to the production of feed crops for dairy cattle. Alfalfa was introduced in 1937. Alsike and timothy are grown.

It is estimated that the barn has room for 25 cows and young stock.

Dairying is the main enterprise. The number of cows was 15 to 16 in 1927; it increased to 24 cows in 1929-32; and dropped to 15 or 16 in 1933-34. Several head of cattle were sold under the U. S. Government buying program in drought areas. The herd had been built up again to 24 cows in 1938.

The operator's financial position is probably rather good, although there appears to be some indebtedness since the purchase of additional land.

Evaluation of changes in butterfat production, 1927-37

The period before 1929 marked the end of the development of this farm. The rapidity with which development took place was probably aided by favorable butterfat prices and an ample supply of family labor. But the shadow of the formative period fell on the succeeding 4 years. During these years butterfat production was maintained in spite of low prices on butterfat and failing crops. Some feed was bought in order to supplement what was grown on the farm. Although this farm family made vigorous efforts to keep up production through 1932, the severity of the crop failures in 1933 and 1934 coincident with low prices broke their morale. Poorer care was given the cows; and milk production fell to one-half of what it had been in 1932. The sales of livestock in 1933 and 1934 involved both cows and young stock, leaving the subsequent years short of replacements. The setback in 1937 was due to a lower number of cows.

The capacity to produce on the 1929-32 level can be restored, if not expanded, because the operator plans to break up more land.

Mr. G

This case is typical of the effect on output of advancing age and the departure of children from the farm.

Review of butterfat production, 1927-37

The production of butterfat which was 2,650 pounds in 1927 rose to an all-period peak of 2,800 pounds in 1930. The low point of the period was reached in 1934 when production was about 2,200 pounds. It recovered some the following years.

Farm organization and operation, 1927-37

Mr. G was 65 years old in 1938. The family consists of Mr. and Mrs. G, two grown boys and two grown daughters. The sons and daughters are now all away from home, and are not interested in farming. Available labor consists of the operator and his wife with some occasional hired labor. Although there has been some replacement of sons' labor with hired help, the regular labor supply has declined during the 10 years. Available labor has become an important factor limiting farm operations.

Mr. G bought the land in 1910. There are 120 acres in this farm. There were 100 acres up to 20 years ago when the operator bought an additional 20 acres, thinking that one of his sons would be interested in staying at home on the farm. There are 65 acres of cropland. There has been no change in acreage operated during the last 10 years. Fifteen acres of alfalfa were raised in 1938. Silage corn is not being raised because of the expense in filling, but there is some corn for fodder. In addition, other tame hay and oats are raised. Although the changes in the cropping program were not definitely described, it is believed that except for some increase in alfalfa and some adjustments to drought, it has remained practically constant.

The farm buildings are in good shape. The barn has capacity for 11 cows and additional young stock and horses. Dairying is the major enterprise. The number of cows averaged around 11 during 1927-30 and up to 10 cows since that time. Poultry is and has been an important supplementary enterprise. Very little feed is bought for cows, although it is generally bought for poultry.

There is no indebtedness on this farm.

Evaluation of changes in butterfat production, 1927-37

In general, the year-to-year changes in butterfat production over this 10-year period are explained by changes in crop yields rather than in number of cows. The decline in family labor and the advancing age of the operator have contributed to the falling trend. This operator expressed his inability to explain changes in production per cow which could not be attributed to changes in amount and quality of feed.

The operator thought 10 cows were all the farm could feed from year to year. This apparently is based on experience from the recent drought period and a smaller quota of purchased feed than in 1927-30. He plans to continue at this level.

Although the price of butterfat was dismissed by the operator as being without any effect on his operations, it appears fair to conclude that it has influenced, in a broad sense, what has happened on the farm, for it is doubtful whether the production of butterfat would have been the same, had the pre-depression prices continued.

The operator was considerably concerned and discouraged about the lack of interest of the younger generation in farming. He could not foresee who would take over the farms when the older generation was gone. There was a scarcely hidden bitterness about the young people's failure to appreciate what the old people had accomplished and endured in hewing a farm out of the wilderness.

Mr. H

Mr. H is a case representing adjustment to lower production by relying more exclusively on home-grown feed, due principally to changes in the butterfat-feed price relationship.

Review of butterfat production, 1927-37

The production which reached a peak of 3,600 pounds in 1929 fell to 2,200 pounds in 1934. The recovery since that year has been rapid, reaching 3,100 pounds in 1937.

Farm organization and operation, 1927-37

This operator was 50 years old in 1938. The family consists of Mr. and Mrs. H and a 30-year old son, the only child. The son is married and lives in a separate building on the farm. He worked on the farm until 1936 but has since that time been employed in the village. As a hired man has generally been employed during the period under consideration, there has not been much change in labor supply during the period.

The farm was bought by Mr. H in 1915. The land area is 155 acres, of which 88.6 acres are cropland. There has been no change in land operated during the period. Alfalfa, silage corn, and oats are regularly grown. Until some years ago a considerable acreage of potatoes was a vital part of the cropping program, as many as 25 acres being raised. This acreage has since been reduced until now only 3 to 4 acres are usually planted. The reduction in potatoes was said to have been caused by lower yields, lower quality, and lower prices. Sweet clover is also grown; it is used partly for hay and partly for soil improvement.

There is adequate room in the barn for 16 cows and a normal number of young stock. There are stalls for 20 cows, and this number could be kept if there were less young stock.

The farmer had up to 19 cows during the period 1926-29; this number was reduced to 14 or 15 in 1931. Except for the drought years when the herd had to be further curtailed, this has been the average number of cows during recent years.

Other enterprises consist of poultry and hogs. These enterprises have been kept substantially the same during the last 10 years.

It has been the practice of this producer to raise the feed needed for dairy cattle, and as long as the home-grown feed supply has been ample there has been no direct relation between butterfat prices and production of butterfat. If the feed supply is short compared with the number of cows, and prices of butterfat are low, the cows are less liberally fed and their number is curtailed if necessary. But if the prices of butterfat are good or the relation between butterfat prices and commercial feed prices is favorable, feed is bought to offset shortages of home-grown feed.

The operator's financial position is very good. The last portion of a farm mortgage was paid in 1928.

Evaluation of changes in butterfat production, 1927-37

The fundamental change of this farm has been the shifting of the effect of home-grown feed shortages from the purchase of feed to reduction in the rate of feeding per cow or curtailment in numbers. The transfer of cash-crop acreage to the raising of feed for livestock has not tended to raise butterfat production but has merely cushioned other adjustments in process. The coincidence of protracted drought and equally protracted low prices intensified the severity of the decline in production and may have impaired the operator's ambition and outlook.

The high level of production of 1927-29 was maintained by purchasing feed to supplement home-grown feed in case of shortages. The price relationships permitted this policy. The crop production was lower in 1930 and the number of cows was reduced, perhaps partly for accidental reasons. The production recovered in 1931 when number of cows was probably larger and crops were somewhat better. The subsequent years through 1934 became progressively poorer through grasshoppers and drought. Feed prices were high relative to butterfat prices, and the level of butterfat prices was very low, tending to throw the entire burden of crop failures on butterfat production.

There was a return of better crops from 1935 on, except for 1936. The number of cows was probably the limiting factor during these years for there was heavy curtailment during the drought period.

There was excess capacity toward the end of the period compared with the 1927-29 level, but this level is not likely to be re-attained, not only because the operator's son has found outside employment, but also because a fair living can probably be secured without working as hard as formerly.

Mr. K

On this farm poor financial condition, the raising of a large family, and advancing age of the operator have combined to cause a decisive decline in butterfat production.

Review of butterfat production, 1927-37

Butterfat production rose rapidly from 1927 to 1929. The production, which was 2,500 pounds in 1929, fell for 7 consecutive years until it reached 700 pounds in 1936. It rose to 1,000 pounds in 1937.

Farm organization and operation, 1927-37

Mr. K is 65 years old. The family consists of Mr. and Mrs. K, five sons, and eight daughters. One son, 21 years old, and three daughters, the youngest of which is 13 years old, live on the farm. The labor supply has been ample during the last 10 years.

Mr. K bought his farm in 1913. There are 200 acres with 82 acres of cropland. There has been no change in number of crop acres during the last 10 years - 30 acres were cultivated when the farm was bought in 1913. Alfalfa and silage corn have been raised regularly, and the general cropping system has apparently remained about the same.

There is room for 21 head of cattle in the barn. Both the barn and the farm house are beginning to show signs of age.

Dairying has been the chief enterprise. In 1929, 15 cows were kept - the largest number this producer has ever had. At the time of the interview, in June, 1938, he had only 5 cows. He had been down to 4 cows in 1937, after selling some to meet services on debt. Other enterprises consist of poultry, hogs, and sheep. The poultry enterprise has remained relatively constant during the last 10 years. The sheep enterprise remained rather constant until 3 years ago; since that time it has been greatly decreased.

The large purchase price paid for the farm, the consequent heavy mortgage, and the raising of a large family have burdened this operator. When the dry years and the depression came, his indebtedness was still large, and financial difficulties arose. He finally (in 1935) had to sell a large part of his herd in order to pay back taxes and carry out a refinancing of the mortgage.

Evaluation of changes in butterfat production, 1927-37

The background factor in decline in production on this farm is the break in butterfat prices which, associated with poor crops, reduced the income to such an extent that taxes, interest, and instalments on indebtedness could not be paid promptly. The large family complicated matters. The morale of the family became impaired, partly because of the advancing age of the operator.

The number of cows rose considerably between 1927 and 1929. Prices and crops were good during those years. By and large, the limiting factor to butterfat production 1930-34 was the supply of home-grown feed rather than number of cows. Since 1934 the low production has been caused by sale of cows to pay back taxes and to accomplish refinancing of the mortgage.

Although the operator plans to restore his herd to 12 cows, whether he can do so depends upon price and crop conditions.

GENERAL SUMMARY

This study of production responses of dairy farmers in east-central Minnesota draws upon data from several sources. A general description of the whole east-central type-of-farming area and its historical development is first given. An analysis of changes in butterfat sales and related variations in crop and livestock production in Kanabec County follows. Data for 130 continuous producers delivering to the Mora Cooperative Creamery make possible a more intensive study of farmers' responses for the recent period 1927 to 1937. Detailed case analyses for 54 of the 130 continuous producers add to the explanation of the underlying reasons for changes in production.

The prevailing type of farming in east-central Minnesota is dairying. This area experienced rapid settlement from about 1870 to 1900 and less rapid settlement from 1900 to 1920. Increases in cropland and in the number of livestock on farms continued steadily until about 1925. Intensification of dairy production proceeded rapidly between 1919 and 1928 in response to relatively favorable prices of butterfat and, assisted by favorable weather, more intensive use of farm resources, herd improvement, and improved feeding and management practices. After 1925 the main changes in the cropping system were a decrease in the acreage of potatoes and an increase in the acreage of alfalfa.

Most farmers in east-central Minnesota have made the dairy enterprise the center of activity and the principal source of income. Through years of good prices and poor, they have stuck to dairying. These farmers try to raise most or all of their own feed, and the quantity of feed the cows receive, and consequently the quantity of butterfat produced, is closely related to crop yields and production. Pasture conditions are very important in connection with butterfat production. This area seldom produces a surplus of concentrate feeds over local needs. Purchases of feed are made sparingly, and are resorted to chiefly when it becomes necessary to supplement home-grown supplies, yet farmers do take advantage of relatively favorable margins between feed and butterfat prices by buying and feeding more heavily.

Variations in the quantity of butterfat produced from year to year since 1928 reflect the influence of variations in weather conditions, crop yields, and the relative prices of butterfat and feed grains, on farmers whose opportunities to engage successfully in other agricultural enterprises than dairying are limited.

An evaluation of persistent responses of dairy farmers in east-central Minnesota for the period 1927-37 must recognize the following characteristics:

(1) The shadow of past events.

The period under consideration reaches back toward an era of rapid expansion in commercial dairying. Committments made before 1927 were brought forward and fulfilled. Farms in the process of development continued to be built up.

(2) A succession of drought years.

(3) Business depression coinciding with drought.

(4) Brevity of the post-drought and post-depression period.

The period after the drought and after the recovery of prices has been too short for full expression of effects of adjustments that are under way.

It is evident from the analysis of trends of the recent past that there has been an increase in cropland per farm in Kanabec County although total acres of cropland per farm have remained about the same. This type of trend was shared by the 54 case farms that were studied in detail. On these, both cropland per farm and size of farm increased.

Corn and alfalfa acreages have increased. The increase in alfalfa acreage has been especially marked. The oat acreage has remained about the same, and barley acreage has decreased, The trend in potato acreage has been downward. There was no significant trend in acreages used for clover and timothy. As the major part of the corn land is used for silage or fodder corn, the net effect of the trend in crop distribution was to reduce the proportion of concentrates to roughage crops. With respect to trends in acreages of major crops grown, the data for the county and the case farms are in substantial agreement.

The changes in the quantity and structure of the feed supply were accompanied by changes in the livestock enterprises. The trend in cow numbers was moderately upward, although the reduction in number of cows as well as an even greater reduction in young stock in 1934 upset relationships which had not been overcome when the period ended. There was some decrease in numbers of other livestock. The tendency with respect to both cropping and livestock programs was to maintain and strengthen the advantage of dairying relative to other enterprises in this area. In this respect also the changes in the county seem to be parallel with the changes on the case farms.

In spite of the above trends the level of production of butterfat has remained practically unchanged. The basis for a considerable expansion in production was laid down, but other factors have served temporarily to offset expansion so the various adjustments have thus far served only to prevent a decline.

The effect of extremely unfavorable growing conditions for crops and pastures during successive years culminating in 1934 caused emergency adjustments. Recovery from the effects of drought was not completed when the period under consideration ended. Butterfat production did not at first decline in response to the rapid fall in butterfat prices from 1929 onward. Instead there was a tendency to maintain production, if not to increase it in the face of low prices. But the co-existence and the duration of cumulatively unfavorable growing conditions for crops and pasture and low prices for butterfat caused an abrupt decline in butterfat production in 1933 and 1934. Production recovered to the former level during the years 1935 to 1937 when crops and growing conditions and prices of butterfat generally improved.

The large variety of individual patterns of response as revealed by trend groups and associated analyses of 54 farmers in the Mora community appears to reflect principally the changes in age of operator and changes in family labor, with related variations in the capacity and efficiency of the labor supply, the corresponding land resources operated, and the size of herd kept. As shifts of enterprises do not explain trends in butterfat production except in a few isolated cases, it is logical that relationships between the labor factor and butterfat output should be fairly close.

The land factor appears to be much less flexible than the labor factor. Although those who increased their production generally operated more land along with increases in labor, those dairymen who decreased production did not decrease land but simply milked fewer cows.

The modified cropping systems are now capable of producing a relatively larger supply of dairy feed than formerly if normal yields are obtained. This situation may result in further increase in the number of cows and an expansion in butterfat production provided economic conditions favor a corresponding increase in labor force and a normal replacement of farmers.

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APPENDIX

Table 25.- Annual butterfat production for nine selected case farms in Kanabec County, 1927-37

Trend group	Operator	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
I	A	1,037	1,424	1,607	1,177	1,809	1,910	1,804	1,707	2,344	1,987	2,341
	B	1,824	1,976	1,741	1,464	1,693	1,934	1,870	1,687	2,863	2,717	2,105
II	C	1,793	2,033	1,913	1,658	2,025	2,099	1,830	1,794	2,298	2,401	1,910
	D	2,520	3,058	2,662	2,721	2,848	3,598	3,331	3,467	3,187	3,144	3,142
III	E	2,751	2,716	2,863	2,696	3,007	2,351	2,567	2,033	2,547	3,100	2,915
IV	F	1,758	2,222	2,656	2,600	2,656	2,592	1,681	1,312	2,142	2,393	1,580
V	G	2,641	2,757	2,687	2,808	2,477	2,585	2,380	2,177	2,323	2,387	2,299
	H	3,385	3,418	3,664	2,760	3,335	2,756	2,398	2,218	2,598	3,012	3,091
VI	K	1,346	2,309	2,576	2,235	2,186	1,828	1,762	1,214	769	740	956

Table 26.- Butterfat sales by creamery patrons in Kanabec County, East-Central Minnesota, 1910-37

Year	All creameries 1/	Mora Creamery 2/			
		130 continuous patrons	100 continuous patrons		54 continuous patrons
			Calendar year	Year ending May 31	
	Pounds	Pounds	Pounds	Pounds	Pounds
1910	141,734	--	--	--	--
1911	219,232	--	--	--	--
1912	341,400	--	--	--	--
1913	393,945	--	--	--	--
1914	321,955	--	--	--	--
1915	230,712	--	--	--	--
1916	365,075	--	--	--	--
1917	400,824	--	--	--	--
1918	403,199	--	--	--	--
1919	387,357	--	--	--	--
1920	652,036	--	--	--	--
1921	938,230	--	--	--	--
1922	1,007,862	--	--	--	--
1923	1,162,497	--	--	--	--
1924	1,385,786	--	--	--	--
1925	1,534,229	270,038	182,212	--	--
1926	1,567,012	262,227	175,365	--	--
1927	1,577,967	261,337	180,305	--	113,963
1928	1,698,377	281,985	199,587	179,454	123,916
1929	1,611,641	279,425	204,291	214,241	122,327
1930	1,485,981	257,576	188,170	201,167	113,663
1931	1,620,744	271,415	198,708	189,471	122,647
1932	1,570,528	260,431	188,600	205,029	118,140
1933	1,477,667	239,142	168,823	171,725	107,356
1934	1,443,106	231,088	169,420	162,397	103,624
1935	1,552,637	258,536	193,660	171,583	115,461
1936	1,638,432	260,408	195,635	200,939	122,870
1937	1,616,779	249,870	189,065	193,965	116,602

1/ Minn. State Dept. of Agriculture, Bulletin of Information on Creameries etc.

2/ Records in Mora Cooperative Creamery.

Table 27.- Weather conditions, crop yields, and feed production in Kanabec County, 1918-37

Year	Total precipitation		Mean temperature (June, July, Aug.)	Average yields of					Total feed production (T.D.N.) 1/
	Annual	4 months Apr. - July		Oats	Barley	Corn	Tame hay	Wild hay	
	Inches	Inches	Degrees F.	Bu.	Bu.	Bu.	Tons	Tons	1,000 pounds
1918	26.07	12.28	67.8	49	36	25	-	-	-
1919	25.49	12.95	69.0	35	24	40	-	-	-
1920	31.22	15.87	67.3	44	24	30	1.70	1.70	-
1921	22.57	9.38	71.3	19	25	43	1.25	1.58	-
1922	25.29	9.03	68.7	45	20	25	1.90	1.69	-
1923	22.71	14.39	69.4	40	24	36	1.25	1.25	-
1924	27.31	12.71	65.4	45	35	24	1.70	1.25	-
1925	20.88	12.80	67.7	47	32	30	1.70	1.30	-
1926	27.88	9.83	67.0	32	27	30	.90	.75	-
1927	26.78	11.22	64.8	34	31	12	2.14	1.40	62,695
1928	29.23	13.97	65.8	37	30	30	2.17	1.57	74,820
1929	20.44	7.21	67.6	31	22	24	1.35	.90	52,503
1930	22.64	12.37	70.1	41	30	20	1.30	1.10	58,334
1931	25.76	11.72	70.6	33	19	30	1.15	.95	53,524
1932	20.72	8.40	70.2	20	13	25	.90	1.15	47,654
1933	20.61	11.35	72.7	17	12	23	.85	.90	43,862
1934	26.30	9.66	70.2	24	20	15	.65	.45	31,017
1935	30.16	14.30	69.4	36	21	26	1.65	1.00	67,144
1936	21.33	5.90	71.5	15	8	10	1.00	.70	37,740
1937	25.52	13.23	70.6	36	22	25	1.60	1.05	-

1/ A T.D.N. rate of 75 percent was used for grain and 50 percent for hay. As corn for silage and corn harvested for grain were not separated in the data, the entire production for all corn has been figured as grain. Acreage in crops for missing years was found by taking the average of the preceding and following years.

U. S. D. A. Weather Bureau reports and Minnesota Crop and Livestock Estimates.

Table 28.- Average annual weighted prices in East-Central Minnesota, 1910-37

Year	Wheat per bu.	Corn per bu.	Oats per bu.	Barley per bu.	Rye per bu.	Flax per bu.	Potatoes per bu.	Hogs per cwt.	Cattle per cwt.	Lambs & sheep per cwt	Chickens per lb.	Eggs per doz.	Butterfat per lb.
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1910	1.02	.54	.37	.56	.63	2.19	.44	7.83	3.30	5.38	.08	.18	.31
1911	.93	.52	.36	.86	.74	2.07	.59	5.83	3.04	4.68	.08	.14	.27
1912	.85	.56	.33	.62	.57	1.55	.44	6.43	3.77	5.22	.11	.17	.32
1913	.79	.55	.32	.48	.48	1.21	.33	7.17	4.81	5.76	.09	.17	.33
1914	.91	.59	.37	.49	.68	1.33	.39	7.11	5.03	5.93	.09	.17	.30
1915	1.02	.65	.36	.55	.85	1.67	.27	6.09	4.65	6.33	.08	.17	.31
1916	1.23	.80	.40	.70	1.01	2.09	.80	8.00	5.13	7.78	.11	.19	.34
1917	2.02	1.28	.58	1.12	1.62	2.93	1.25	13.73	6.65	12.24	.13	.30	.43
1918	2.05	1.35	.69	1.22	1.70	3.56	.73	15.96	7.84	13.10	.17	.32	.50
1919	2.24	1.35	.61	1.01	1.34	4.01	1.19	16.08	8.12	11.80	.17	.37	.60
1920	2.16	1.22	.59	1.07	1.52	3.12	1.41	12.54	6.76	10.62	.20	.39	.62
1921	1.15	.45	.28	.44	.91	1.58	.86	7.12	4.11	6.40	.15	.23	.37
1922	1.07	.50	.29	.45	.63	2.12	.53	8.02	4.07	9.20	.13	.21	.37
1923	1.02	.68	.34	.47	.58	2.26	.40	6.46	4.29	9.78	.13	.22	.45
1924	1.22	.77	.40	.64	.82	2.25	.38	6.58	4.17	10.22	.14	.22	.43
1925	1.44	.79	.35	.61	.90	2.45	.65	10.30	4.86	11.91	.15	.27	.46
1926	1.36	.61	.34	.52	.79	2.08	1.45	11.25	5.38	11.28	.16	.26	.45
1927	1.19	.77	.42	.62	.82	2.00	.73	9.10	6.10	11.03	.15	.21	.49
1928	1.04	.78	.40	.67	.91	1.98	.56	8.03	8.33	11.51	.17	.26	.50
1929	1.08	.75	.40	.53	.86	2.66	.63	9.11	8.36	11.01	.17	.27	.49
1930	.79	.70	.33	.44	.49	1.86	.98	8.50	6.62	7.26	.14	.20	.38
1931	.55	.50	.20	.31	.28	1.24	.40	5.39	4.68	5.42	.12	.14	.28
1932	.47	-	.20	.30	.27	.94	.21	3.23	3.79	4.40	.09	.11	.20
1933	.69	.44	.26	.34	.54	1.52	.35	3.22	3.22	5.01	.06	.12	.21
1934	.94	.44	.45	.67	.63	1.72	.57	3.87	3.56	5.78	.09	.14	.25
1935	1.00	.57	.23	.43	.37	1.44	.31	8.42	5.87	7.62	.14	.22	.30
1936 1/	1.38	.67	.29	.65	.55	1.85	.58	9.07	5.44	7.97	.11	.18	.35
1937 1/	1.08	.62	.28	.57	.70	2.10	.72	9.19	6.50	8.49	.14	.18	.36

1/ The prices for 1936 and 1937 are estimated from the average annual prices for the State for these 2 years. Division of Agr. Economics, University of Minnesota, Crop Estimate data.

Table 29.- Price per pound paid for butterfat by The Farmers' Cooperative Creamery Company of Mora, 1925-37

Period	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
January 1-15	41	48	54	53	54	40	31	26	21	20	36	38	38
January 16-31	41	49	54	54	55	40	30	23	17	24	42	40	39
February 1-15	43	50	56	50	56	38	30	23	18	26	40	43	38
February 16-28	48	50	56	54	54	36	30	23	16	29	35	38	38
March 1-15	52	46	53	55	53	38	31	24	18	27	32	36	39
March 16-31	48	45	59	51	50	42	30	22	18	24	39	35	39
April 1-15	48	41	55	50	49	42	25	20	21	24	37	36	36
April 16-30	46	41	53	50	51	40	25	20	24	27	33	32	35
May 1-15	45	44	49	50	47	38	24	19	24	26	30	30	35
May 16-31	46	45	48	48	48	35	23	18	23	26	28	31	35
June 1-15	45	45	47	48	49	36	23	17	24	26	26	33	34
June 16-30	45	45	46	49	49	36	24	16	27	27	25	35	34
July 1-15	45	44	46	50	48	38	25	17	28	26	25	38	34
July 16-31	47	45	45	50	50	40	26	19	24	28	26	41	35
August 1-15	47	46	45	53	50	43	30	20	20	31	27	42	36
August 16-31	48	47	48	54	50	44	30	20	26	30	29	41	37
September 1-15	52	48	51	55	51	44	34	20	26	29	28	41	40
September 16-30	54	48	55	56	52	45	38	21	26	29	30	37	40
October 1-15	55	50	55	55	51	45	38	21	26	30	32	36	40
October 16-31	56	52	54	56	49	45	34	21	26	31	33	38	40
November 1-15	56	54	54	58	46	40	34	23	26	32	36	38	43
November 16-30	55	59	56	60	47	38	34	26	26	35	38	38	43
December 1-15	54	62	57	58	44	33	33	26	18	35	38	38	41
December 16-31	52	60	59	58	44	32	30	25	19	36	41	38	41

Compiled from record in the office of The Farmers' Cooperative Creamery Company at Mora, Minnesota. The figures given in this table represent the prices paid for sweet butterfat. The price paid for No. 1 butterfat was consistently 2 cents less than the price paid for sweet during the entire period, 1925-37.

Table 30.- Butterfat sold by 54 patrons of the Mora Cooperative Creamery, by sub-groups, 1927-37
(1927-29=100)

Year	TREND OF SALES													
	Decidedly upward (8 farms)		Upward (12 farms)		Slightly upward (4 farms)		Slightly downward (10 farms)		Downward (16 farms)		Decidedly downward (4 farms)		Total (54 farms)	
	Total sales	Relatives	Total sales	Relatives	Total sales	Relatives	Total sales	Relatives	Total sales	Relatives	Total sales	Relatives	Total sales	Relatives
	Pounds		Pounds		Pounds		Pounds		Pounds		Pounds		Pounds	
1927	8,667	85.6	24,019	95.1	10,984	94.6	19,532	96.3	43,308	98.9	7,453	82.8	113,963	94.9
1928	10,879	107.4	25,522	101.1	12,362	106.4	20,610	101.6	45,323	103.5	9,220	102.4	123,916	103.2
1929	10,845	107.0	26,190	103.7	11,489	98.9	20,702	102.1	42,770	97.6	10,331	114.8	122,327	101.9
1930	11,497	113.5	24,553	97.3	11,412	98.3	19,213	94.7	38,396	87.7	8,592	95.4	113,663	94.7
1931	12,554	123.9	28,975	114.8	10,937	94.2	20,179	99.5	41,085	93.8	8,917	99.1	122,647	102.1
1932	13,374	132.0	29,356	116.3	9,633	83.0	19,257	95.0	38,592	88.1	7,928	88.1	118,140	98.4
1933	13,541	133.7	26,205	103.8	9,697	83.5	15,996	78.9	36,325	82.9	5,592	62.1	107,356	89.4
1934	12,795	126.3	24,799	98.2	10,019	86.3	16,315	80.4	33,493	76.5	6,203	68.9	103,624	86.3
1935	15,816	156.1	28,830	114.2	11,463	98.7	18,388	90.7	35,865	81.9	5,099	56.6	115,461	96.2
1936	17,029	168.1	31,759	125.8	13,385	115.3	20,096	99.1	36,084	82.4	4,517	50.2	122,870	102.3
1937	15,521	153.2	30,036	119.0	11,617	100.0	18,845	92.9	35,880	81.9	4,703	52.2	116,602	97.1
Average 1927-29	10,130	100.0	25,244	100.0	11,612	100.0	20,281	100.0	43,800	100.0	9,001	100.0	120,069	100.0
Average 1935-37	16,122	159.2	30,208	120.0	12,155	104.7	19,110	94.2	35,943	82.1	4,773	53.0	118,311	98.5

Table 31.- Number of cows kept by 50 patrons of the Mora Cooperative Creamery, by sub-groups, May, 1927-37
(1927-29=100)

Year	TREND OF SALES													
	Decidedly upward (7 farms)		Upward (11 farms)		Slightly upward (4 farms)		Slightly downward (9 farms)		Downward (15 farms)		Decidedly downward (4 farms)		Total (50 farms)	
	Total cows	Relatives	Total cows	Relatives	Total cows	Relatives	Total cows	Relatives	Total cows	Relatives	Total cows	Relatives	Total cows	Relatives
	Number		Number		Number		Number		Number		Number		Number	
1927	39	108.3	96	106.7	41	107.9	73	102.8	147	106.5	32	91.4	428	104.9
1928	33	91.7	84	93.3	36	94.7	66	93.0	126	91.3	31	88.6	376	92.2
1929	37	102.8	90	100.0	37	97.4	74	104.2	141	102.2	42	120.0	421	103.2
1930	42	116.7	82	91.1	37	97.4	76	107.0	122	88.4	37	105.7	396	97.0
1931	48	133.3	103	114.4	37	97.4	85	119.7	133	96.4	31	88.6	437	107.1
1932	53	147.2	101	112.2	43	113.2	89	125.4	131	94.9	42	120.0	459	112.5
1933	57	158.3	95	105.6	41	107.9	80	112.7	141	102.2	33	94.3	447	109.6
1934	52	144.4	112	124.4	45	118.4	80	112.7	134	97.1	36	102.8	459	112.5
1935	45	125.0	101	112.2	36	94.7	79	111.3	128	92.8	27	77.1	416	102.0
1936	58	161.1	101	112.2	40	105.3	77	108.4	126	91.3	24	68.6	426	104.4
1937	60	166.7	109	121.1	39	102.6	82	115.5	128	92.8	18	51.4	436	106.9
Average 1927-29	36	100.0	90	100.0	38	100.0	71	100.0	138	100.0	35	100.0	408	100.0
Average 1935-37	54	150.0	104	115.6	38	100.0	79	111.3	127	92.0	23	65.7	426	104.4

Table 32.- Percentage that "other cattle" were of cows on farms of 50 patrons of the Mora Cooperative Creamery, by sub-groups, May 1, 1927-37

Year	TREND OF SALES												Total (50 farms)	
	Decidedly upward (7 farms)		Upward (11 farms)		Slightly upward (4 farms)		Slightly downward (9 farms)		Downward (15 farms)		Decidedly downward (4 farms)			
	Total	Percentage of cows	Total	Percentage of cows	Total	Percentage of cows	Total	Percentage of cows	Total	Percentage of cows	Total	Percentage of cows	Total	Percentage of cows
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1927	20	51.3	73	76.0	21	51.2	87	119.2	96	65.3	20	62.5	317	74.1
1928	44	133.3	78	92.8	38	105.6	97	147.0	100	79.4	27	87.1	384	102.1
1929	33	89.2	93	103.3	30	81.1	87	117.6	119	84.4	26	61.9	388	92.2
1930	37	88.1	86	104.9	36	97.3	86	113.2	117	95.9	21	56.8	383	96.7
1931	53	110.4	81	78.6	37	100.0	101	118.8	97	72.9	29	93.5	398	91.1
1932	43	81.1	87	86.1	36	83.7	97	109.0	126	96.2	33	78.6	422	91.9
1933	52	91.2	96	101.0	38	92.7	106	132.5	123	87.2	25	75.8	440	98.4
1934	51	98.1	90	80.4	36	80.0	66	82.5	103	76.9	18	50.0	364	79.3
1935	34	75.6	52	51.5	34	94.4	65	82.3	63	49.2	6	22.2	254	61.0
1936	39	67.2	85	84.2	31	77.5	78	101.3	86	68.2	11	45.8	330	77.5
1937	41	68.3	80	73.4	37	94.9	65	79.3	114	89.1	15	83.3	352	80.7
Average 1927-29	32	88.9	81	90.0	30	78.9	90	126.8	105	76.1	24	68.6	363	89.0
Average 1935-37	38	70.4	72	69.2	34	89.5	69	87.3	88	69.3	11	47.8	312	73.2